DEPARTMENT OF AGRICULTURE,
NEW SOUTH WALES.

▽

Vegetable Growing

∴ IN ∴

NEW SOUTH WALES.

A. J. PINN and R. N. MAKIN,
Inspectors of Agriculture.

Issued by direction of
The Hon. W. F. DUNN, M.L.A., Minister of Agriculture.

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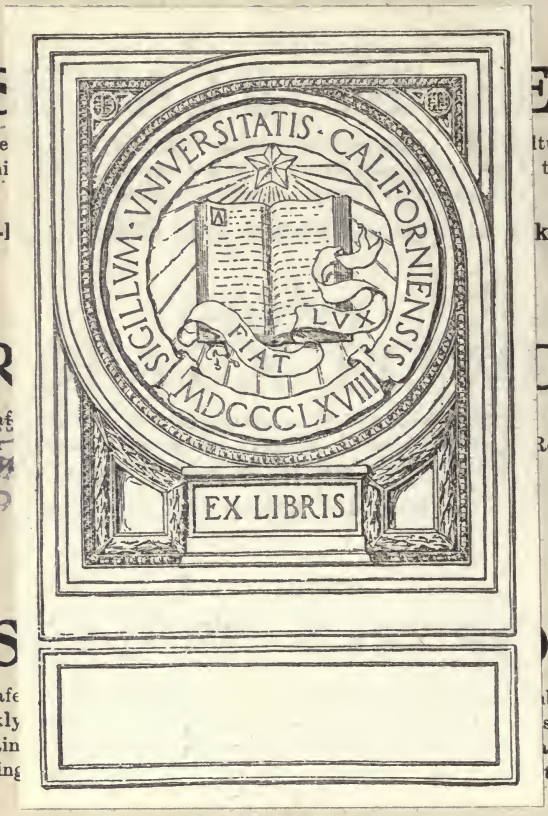

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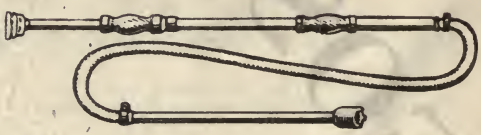

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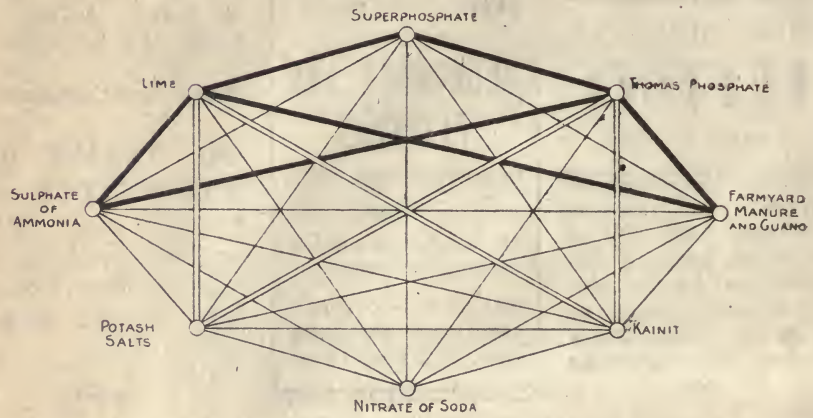

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PREFACE.

Increased production is the only practical solution of the problems of high prices and scarcity, under which every country in the world is labouring at the present time, and the solution does not rest alone with those who are farming large areas. Consumers can help themselves and their fellow citizens by becoming producers according to their own opportunities, and this many can do by raising vegetables on such small areas as are available round their own homes. Probably nine-tenths of the residences in New South Wales have a plot of ground large enough to raise a substantial quantity of fresh vegetables—almost sufficient for the requirements of the household.

Despite the disadvantages of time and distance by which they are seemingly prejudiced, and the wide areas of suitable land in this State that could easily be made to supply the whole of our own requirements, large quantities of vegetables, grown in Victoria and Tasmania, successfully compete with locally-grown produce in our markets. The bulk of the home-grown vegetables offered for sale in Sydney is raised by Chinamen, while in Victoria the celestial has long ago been almost forced out of the business by the white grower. It was one of the impressions derived by many of our "diggers," that the supply of vegetables in all European countries was in the hands of growers of their own nationality. Why it should be otherwise in New South Wales is not clear.

Contrary to popular opinion, vegetable growing does not demand such long hours as the industrious Mongolian suggests. Like any other business it requires the commonsense application of up-to-date methods, an intelligent recognition of the principles underlying the control of contrary elements (pests and diseases), a capacity to apply energy in the right direction, and sufficient business ability to run the place on commercial lines. Sound methods are reflected in the quantity and quality of the crops, but careless, unsystematic, labour-wasting practices have their reflex in unprofitable and unattractive products.

The present publication indicates the methods adopted on the Department's experiment farms, and by the most successful commercial growers in the State. An effort has been made so to present the various recommendations that growers in different parts of the State can readily adapt them to their own peculiar conditions.

The book is particularly intended to be of use to the small market gardener and the suburban resident. It is hoped that as the initial effort of the kind, it will prove practically useful and suggestive.

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SUITABLE SITES FOR MARKET GARDENING.

VEGETABLES are raised in New South Wales under a great variety of conditions—such a variety, indeed, that many popular edibles are on the market in Sydney and other towns most of the year round. So easily are they grown, too, that there is hardly a spot where sufficient for average household purposes cannot be raised on a small area at no greater expense than a little manual labour.

Success will depend in part, however, upon the choice of a suitable site. With this aspect of matters the ordinary suburban resident is not so much interested, for he is influenced by domestic and business convenience in choosing his locale, and he must therefore adapt his vegetable growing to his conditions.

The small market gardener—to whose requirements the following pages are largely directed—must regard the selection of a suitable district and site as one of the first essentials of success.

Upon the choice of the land, indeed, depends a great deal more than might at first sight appear, for not only must the quality and character of the soil, the supply of water, and the aspect, be kept in view, but even the locality in which operations are to be carried on has an important relation to the ultimate success of the undertaking. The nature of the crop or crops, the market to be catered for, the facilities for forwarding the produce and for obtaining supplies of manure, as well as the capital available and the price of the land, must all operate as factors in the choice of the district in which the produce is to be raised.

For market gardening, distinctions must be drawn, for instance, between areas near the city, with their great variety of produce, and those farms where the ordinary activities of agriculture are combined with the growth of some vegetable for which a special piece of land and the climate provide favourable conditions. It is under such circumstances as the last that

cabbages and cauliflowers are raised in considerable quantities in the Moss Vale and Bathurst districts respectively. A third class of vegetable grower may be indicated here as likely to be controlled by special conditions when he comes to the choice of a suitable locality, namely, he who intends to produce quite a number of crops, but to specialise in one or two as main lines. This method is found profitable because of the particular knowledge of the main crop that is gradually acquired, the possibility of treating it on an extensive scale, and the reduction of the trouble incidental to marketing. To carry on operations on such lines it is obvious that a locality and climate suitable to the main crop must be chosen. The possibilities of failure in one season, or of an over-supply in another, have to be regarded as disadvantages of this method, and greater security probably attaches to the number and variety of crops that are produced in the ordinary market garden, though the varied knowledge and skill, and the foresight required to manage such a venture, are certainly greater.

The man who goes looking for a suitable site for market gardening requires, therefore, to have some clear idea of his intentions, for upon this, as well as upon his experience and capital, much will depend.

The Market catered for.

The class of market for which it is proposed to cater may be considered first. If financial resources and other qualifications limit the venture to a small area of mixed crops, it will possibly be found that a small town or suburban market is more suitable for the purpose than the city market, but where personal preferences would lead to specialisation in one or two crops on a limited area, it becomes almost imperative that the whole or a large part of the produce shall be forwarded to a distributing centre. In the first case, the grower will probably find it much more profitable to make his sales by hawking his produce from house to house, and he will then require to ensure that his site does not involve undue waste of time in carting. In the second case, proximity to the market is perhaps less important, so long as the means by which the produce can be forwarded are convenient and speedy.

Where operations are to be conducted on a larger scale, the locality will be selected with a view to supplying the metropolitan or some other large market. A preference for some particular line may necessitate the choice of a district suitable to that crop, and distance may then be of less importance, providing the transit is good. Where green vegetables of the class that perish or depreciate quickly are contemplated, it is generally found that no site is so satisfactory as one close to the centre that is to be served, and still more is this the case if, as some have successfully done, a direct trade with large hotels or restaurants is contemplated.

Possibilities present themselves for the grower situated close to some important inland railway junction, where crops can be grown that will find ready market in dry western districts during the summer. Orange suggests

itself as a case in point, being at the centre of practically the whole central-western railway system; but there are other junctions hardly less worthy of mention. The importance of the water supply to such an enterprise is obvious, but quite a number of our western towns are fairly well equipped in that respect.

The Effect of Climate.

Reference has already been made to the effect of a possible preference for one crop or another upon the choice of the locality in which operations should be begun. The climatic conditions, in fact, will largely decide what vegetables shall be grown. It is quite obvious that the warmer conditions of the North Coast, for instance, offer completely different possibilities to those ruling on the cooler upland districts. New South Wales is particularly well situated in its range of climatic zones, the effect being an almost continuous supply of quite a number of vegetables.

The warm humid districts are most productive, but at the same time they are more subject to disease than the more temperate climes. The warm districts, of course, are the first to place their products on the market, and as the weather becomes warmer the cooler districts come forward in their turn, and are often followed again by late crops from the warm districts. Potatoes may be quoted as a case in point. They are naturally a cool climate crop, and are grown in the spring and harvested in the months of November, December, and January on the North Coast. By the middle of January the crops of the lower coastal regions are coming forward. The exhaustion of this source of supply sees the tableland crops available, and these furnish the supply throughout the winter and until November, though a small second North Coast crop generally comes in during May and June. A somewhat similar rotation can be found in a number of crops. Peas and beans, for instance, are available in this way for the greater part of the year.

Marketing Methods and Facilities.

The method by which the produce of the vegetable garden is to be marketed should receive some consideration in connection with the choice of a locality. If the land is some distance from the market, the grower is practically compelled to make his sales through a commission agent. Of growers who specialise in one or two crops, some follow the consignment to market and personally dispose of it, and in this case personal expenses must be considered as against agents' charges. In a vegetable-growing community, co-operation by growers in transporting their goods to market effects a saving in time and money.

The question of direct supply to the consumer per rail and by city delivery has often been raised, but with the present high freights this method of marketing is not likely to become popular.

A word of warning might be interpolated against venturing extensively on lines for which a market does not already exist. The creation of a demand for a new article is a task requiring particular ability and a good deal of capital.

Not less important than proximity to the market are the facilities that exist for forwarding the produce. It is quite possible for all that has been indicated in the foregoing to be ensured, and yet the means of transport to be so slow and otherwise unsatisfactory as to spell failure for the enterprise. Freshness is a necessary qualification where the best ruling rate is to be obtained, and good road or quick train or steamer transit is therefore essential. To avoid much of the delay and reduce the damage which usually attaches to transit by rail, land should be selected that is situated on a main trunk railway line; branch lines necessitate extra handling, and therefore delay. The experienced grower of green vegetables knows that, no matter how good may be the quality of his produce, there will be little profit if any avoidable waste of time takes place between the harvesting of the crop and its sale to the ultimate consumer.

The Manure Supply.

The conveniences and facilities just referred to have also a close connection with the important subject of regular and ample supplies of manure. The subject of manures in relation to vegetable gardening need not be discussed here, but it is opportune to point out briefly that not only are fertilisers necessary, but wherever intensive cropping is going on, material must regularly be added to the soil to maintain its humus content. Stable manure is the ideal material for the purpose, but is apt to prove expensive if the haulage, whether by road or rail, is long. Growers who are located near large towns or cities are in a position to obtain supplies from convenient stables, and to do the carting themselves on the way back from market.

Growers situated close to the railway line can obtain constant supplies of city street sweepings from the Sydney Municipal Council, or Flemington (Homebush Stock Saleyards and Abattoirs) by arrangement with the contractor. The price of the street sweepings is 15s. per 6-ton truck, f.o.r. Sydney, and the freights per ton are:—10 miles, 1s. 7d.; 20 miles, 2s. 1d.; 30 miles, 2s. 7d.; 40 miles, 3s. 6d.; 50 miles, 4s. 4d.

Commercial fertilisers are available to all, and the transport cost should not in any case be a bar to their use.

Suitable and Unsuitable Soils.

From the foregoing it will be gathered that the intending market gardener must have regard to quite a number of considerations in selecting the district or locality in which he will settle, but there are several factors of importance that should influence him in the final selection of the piece of land on which operations are to be carried on.

Undoubtedly one of the main essentials to success in vegetable-growing is that the soil should be suitable for the purpose. That the soil should be very rich is not so important as that it should be a suitable medium on which to build up fertility. Sandy soils are the best, being easy of tillage, usually better drained, and warmer—matters of considerable importance. There is no dearth of suitable land in this State, as most classes of soil can be brought to a suitable tilth, but heavy clay and undrained soils should be avoided for market gardening purposes. Where the suburban householder is obliged to operate under such conditions—as many are in the vicinity of Sydney—lime should be freely used to improve the texture, and drainage should be provided for, if possible. If the contour of the land will not admit of underground drainage, a system of raised beds will be found necessary. To make heavy soil of this class more friable, liberal quantities of organic manure must be applied after the ground has been broken up.

Some soils are naturally well adapted for the culture of vegetables. The most important of these are river-flat lands, the soils of which are usually free-working loams of alluvial formation. By reason of their location they are usually well drained, but many are liable to inundation by flood waters There are also many inland soil pockets, situated amongst the hills in various districts, which are admirably suited for the purpose, and which need little preparation. Many of the low-lying soils, such as are often found in swampy areas, are of a peaty nature, and when drained and sweetened are excellent from a gardener's point of view.

Preference should be given, if possible, to soils that will favour the early development of plants. Generally speaking, sandy soils, being well-drained, friable, and warm, conduce to early and rapid growth, and thus enable the grower to market his produce, or a good part of it, before large deliveries have depressed prices. Unchecked steady development of vegetable crops of all kinds is always desirable, the effect being apparent to the consumer in the quality and attractiveness of the goods. Quick-growing crops, too, mean that the ground is occupied for a shorter period, and that it can be the sooner and more effectively prepared for the next crop in the rotation.

Generally speaking, it can be stated that good vegetable soils are the highest priced lands in the district.

Ensure Plenty of Water.

A reliable water supply is imperative for the production of vegetables, with most of which good quality is only obtained by quick growth—as already remarked—and this is only secured when the moisture requirements are adequately met.

Where ample supplies of water are assured the best returns are obtained, particularly during dry weather when market supplies are limited. Abundance of water is also necessary for the household, the cleansing of root vegetables, and the requirements of live stock. A water service may be obtained from a local body or from some private supply, or else drawn from a spring, dam, well, creek, or a river.

Aspect.

The most favourable aspect for vegetable-gardening is a north-easterly one; such a slope is open to the early morning sun, and affords protection from the westerly and southerly winds—a combination that ensures earliness. If low, flat land is to be used for the purpose there should, if at all possible, be a natural breakwind on the west, whence come most of our cold winds in winter and hot winds in summer. The low lands are the best suited to the cultivation of vegetables during the summer, but for winter growth sloping elevations are preferable, and will result in better air drainage, and less damage by frost. Steep hillside land is unsuitable, being difficult to work and liable to washing. Where there is no natural windbreak some form of protection should be provided, such as a high fence, or hedge or trees should be planted for the purpose. The disadvantage of both hedges and plantations is that they draw very heavily on the supples of plant-food and moisture for a considerable distance around, making the soil less valuable for the culture of vegetables.

Size of the Area.

No attempt has been made in the foregoing to indicate the area that might make a profitable vegetable garden. So much depends upon the exact intentions of the grower, the nature of his previous experience, and the amount of his capital that it is impossible to make any definite recommendation. It may be said, however, in general terms that it is always advisable to commence in the small way, increasing the area as proficiency and confidence are attained as the result of experience. It is a common fault with beginners to attempt the cultivation of too much land as a start, the consequence being indifferent methods of cultivation and tillage, and therefore a stagnant condition that is unprofitable.

In the metropolitan district, the area worked by Chinamen under conditions of intense culture averages about one acre per man. It is not suggested that any reader of this publication should confine himself to that area. Indeed, larger areas can usually be more profitably worked if the crops are grown on a less intensive system so as to allow of a certain amount of horse cultivation.

The Capital Required.

No definite statement can be made as to the amount of capital required, there being such a variety of conditions under which vegetable-growing may be undertaken. The principal contingencies that must be provided for at the outset may be indicated under the following headings:—

(1) Purchase of land and residence, or rental for same.
(2) Clearing of land and preparation, including drainage if necessary.
(3) Improvements, such as fencing, packing shed, hot and cold frames, and other erections of a more or less permanent nature.
(4) Provision of water supply.
(5) Necessary tools, implements, and live stock.
(6) Seed, manure, and fertiliser.

It will also be necessary to make provision for working and living expenses until such time as returns can be expected. Necessarily this last will vary a good deal with the district, the intentions of the grower, and the condition of the land itself; but careful account must be taken of the item, and where uncleared land has to be prepared the amount available will have to be considerable, or some other occupation may have to be followed until the vegetable-growing venture has advanced far enough to bring returns within measurable distance.

Of necessity the prospective grower must work out the approximate cost of everything as listed above, and he would be wise also to make a liberal allowance for a reserve of capital to meet unforeseen expenses of the kind that inevitably occur as an enterprise of this kind develops.

CULTIVATING THE VEGETABLE GARDEN.

Choice of a district and of land suitable to the purpose intended having been made on the lines indicated in the preceding pages, the next concern of the vegetable grower is the preparation of the site generally and the beginning of the preliminary tillage. Some consideration will require to be given at the outset to the lines on which the property is to be laid out with

A well-cultivated crop of Cabbages.

a view to ultimate convenience. It is quite possible so to locate the stable, implement shed, packing house, hot beds, cold frames, and so forth, as to make the farm unnecessarily expensive to work when it is has been fully developed; and a fairly intimate knowledge of the area is therefore desirable before anything is done that may afterwards be regretted. On a small area the placing of the buildings so that advantage is obtained from every possible yard of good soil may become an important matter.

For successful vegetable culture the preparation of the ground requires to be both deep and thorough. Rapid, vigorous growth, such as is desirable in vegetables, requires ample soil from which the roots can draw plant-food; and, clearly, this is not provided if the subsoil is stiff and unkindly. Especially must the cultivation be deep, and this involves that the ground must have been cleared in a conscientious manner. Hence, if it is uncleared land that is being taken up, arrangements must be made to ensure that not only is the timber removed, but the roots are "run," and taken out to a depth of not less than 12 inches—deeper still is better and advisable. If the work is delegated to a contractor, it will be well to provide (1) that the roots shall be "run" as stated; and (2) that after the clearing the contractor shall follow the plough and subsoiler to clear away any roots disclosed by the first working.

The Value of Deep Working.

The depth to which the soil is worked will depend on the class of soil and subsoil, but in fair average soils it should be, at the very least, 8 inches Sandy soils do not require to be worked to such a depth as those of a loamy or clayey nature. Soils of the latter class should always be deeply stirred, though not necessarily wholly by inversion, for often it is better at the first ploughing to follow the mouldboard with a subsoiler than to set the plough so deep as to bring clay to the surface. Time was when vegetable gardening would not have been contemplated if the land were not well trenched first; but under present rates for labour the operation, valuable though it is, is too expensive. In commencing a garden of any appreciable area, it will be found cheaper to have the preliminary work done by horse power. Where it is intended to raise crops by intensive methods of culture, it may not be possible to use horse implements after the ground has once been laid out and cropping commenced; hence the necessity for a thorough tillage and subsoiling in the first place. Only in the small home garden is it possible nowadays to do the subsoiling by hand. There it will be found profitable, and, in the great majority of cases, essential.

This point of thorough and deep tillage is of such importance as to justify emphasis being laid upon it. No amount of intertillage at a later stage will fully compensate for faulty preparation before sowing. Plants will only grow to perfection where the root systems are allowed room for full development, and this is only possible on thoroughly prepared land.

Nor must this advice be restricted to new land. Between each crop the soil should receive a good deep working prior to the preparation of the seed bed. Land that is not to be cropped during the winter, for instance, should always be turned over in the autumn and allowed to weather. This working is not only valuable in connection with the storage of moisture and the increase of the plant-food prepared by soil bacteria under the improved conditions, but it enables the ground to be brought into better tilth in the spring, and much sooner than if it had not been so treated.

The Effects of Tillage.

It may be convenient at this stage to remark that the effects of cultivation upon the soil are numerous and complex, but they are of such importance that the vegetable grower should acquire at least a general impression of what they are, and of their close relation to the success of any agricultural or horticultural enterprise.

Left to itself, land usually produces abundantly if the rainfall is a fair one, but the vegetation is not of the class that is desired by civilised man, and it is therefore the first business of the grower to destroy the class of vegetation the soil is naturally producing, and to make its decay a means by which more desirable plants can be raised. The object, therefore, is to destroy that which is already growing upon the land, and to turn it under so that it will be out of the way of subsequent operations. In that position it will decay, or humify, thus improving the physical qualities of the soil, and providing the crop with plant-food.

It is one object of ploughing that it may be possible at a later stage to reduce the surface soil to a fine tilth by the use of harrows and cultivators, and it sometimes happens, especially on new land, that though that which previously grew on the surface has been effectively turned under, the finer implements cannot be employed until a second ploughing at right angles to the first has been given. A fine seed-bed must ever be kept in view as one of the objects of tillage.

Another effect of ploughing is to enable moisture, whether supplied naturally or artificially, to sink through the surface soil into the subsoil where it may be retained. Soils vary much in their capacity to hold moisture while yet remaining arable and in good physical condition, and on the other hand, plants also show a considerable range of adaptability. It is possible for a soil to contain from 20 to 25 per cent. of water and yet not be too moist for cultivation, while on the other hand plants are able to maintain themselves and grow when the soil contains only 6 to 8 per cent. of moisture.

The storage capacity of a soil is so much increased by deep cultivation that this becomes one of the chief reasons for subsoiling. If a heavy rain falls on land that has only been worked 4 inches deep the tilled soil is in danger of being water-logged. On the other hand, land that has been worked to a depth of 12 inches can absorb a much larger rainfall without becoming too wet, simply because the deep working has provided such a large quantity of loose friable soil to take up the moisture. Just as a large sponge will hold more water than a small one, so a big bulk of tilled earth will hold more water than a small bulk of it. The surface of a deeply worked soil can be loosened sooner after rain than that of a soil that has only been superficially worked. Moreover, the disadvantages of shallow ploughing are increased by the readier loss of moisture; partly because so much is retained near the surface within reach of sun and wind, and partly because in most situations

the surplus can escape so much more easily by run-off or gravitation. Again, the crop will feel the effects of dry weather much more quickly when the ploughing has been shallow.

The deep breaking up recommended has thus a close connection with the retention of moisture.

Yet another effect of cultivation of the soil is the admission of air. Unlikely as it may appear, air is as essential to fertility as water. If a soil is compact, or if its interstices are filled with water or with fine silt, it cannot contain the air that the roots of plants require, and that is necessary to the minute organisms, called soil bacteria, that play an important part in the preparation of plant-food. Moreover, it is possible for too much air to be near the surface and too little below, with the result that while seed may germinate satisfactorily, the plants may not do as well as they should when the roots strike downwards. Cultivation aerates the soil, but it must be carried deep enough for the plant roots to get all the air they require.

The disturbance of the soil, too, has some effect upon its temperature. If the connection of the surface soil with that just below is interrupted by the plough or other implement, the great heat of the sun in summer, for instance, cannot be so readily communicated to deeper levels. The most important action in this connection, however, is the improvement in soil temperature in spring as a result of cultivation. A soil saturated by winter rains will be kept cold in spring by the rise to the surface of the water stored below; cultivation, however, will break the connection as just stated, and prevent the rise of the water, so that the surface soil will dry to a certain extent, and be the more quickly warmed by the action of the sun. The value of this where early, quickly-grown, spring vegetables are desired for the market needs only to be indicated.

Soils that are of such close texture that water passes very slowly through them are most unfavourable. Standing water damages the plants and prevents bacterial activity, so that areas deficient in natural drainage should not be used for vegetables. In fact, with extensive areas that are suitable in most other respects, it is unlikely that the swampy lands of New South Wales will require to be handled for a considerable time. Where, however, the condition has to be dealt with, only deep, open, or underground drains can be recommended. Their effect is to carry off the surplus water, to permit air to pass through the interstices of the soil, and to facilitate the drying up of some of the excessive moisture.

Surface Cultivation.

In addition to the deep cultivation so far kept in mind, it may be pointed out that moving the top inch or two of soil has also important functions. Generally speaking, surface cultivation is carried out in gardens for the purpose of destroying weeds, but it also conserves moisture—indeed, so valuable and appreciable are its effects in this direction that, even in the absence of weeds, the surface should be kept in a loose and friable condition.

Exhaustive experiments have proved that to disturb the top soil prevents moisture from rising to the surface, where sun and wind can carry it off by the process of evaporation, and that the effect of neglecting the surface in summer is simply to allow the moisture (so precious at that time of the year) to escape into the air. The only convenient way of preventing loss by evaporation is to maintain a dry, loose surface, freshening it every time rain, irrigation, or tramping sets it down again. The top 12 or 18 inches of soil are the most important to plant life, but beneath that is usually stored a reserve of water which is conducted to the surface by fine capillary tubes. Once the connection between subsoil and surface is established, and capillary action can proceed freely, the moisture below will rise steadily to the surface, where it will pass off into the air. The gardener who wishes to be successful must register a resolution that, so far as his property is concerned, compacted and neglected surfaces shall not be tolerated—that, in other words, loss of moisture by capillarity and evaporation shall be reduced to a minimum.

While a soil mulch is perhaps the most convenient method of preventing evaporation, stable manure and straw are also largely used for the purpose, their effect being to prevent the sun and wind from too close contact with the soil surface. In raised beds, where it is often difficult to maintain the sides in a loose condition without constant washing down, the sides should be covered with some mulching material in order to prevent loss of moisture.

The only time when the gardener should excuse in his own mind any loss of moisture is in the germination of fine seeds. It is then necessary, in order to obtain a good percentage of germination, to reduce the soil to a fine tilth, and to roll it after sowing the seed. This brings the moisture to the surface, by consolidating the soil so that capillary movement of the subsoil moisture is set up; germination is thus ensured. But even in such cases the surface should be broken as soon as the plants are established. In the case of seeds (such as onions, &c.) sown by a hand-seed-sower, the rolled portion between the rows should be disturbed immediately after sowing.

The Eradication of Weeds.

With many, weeds are the chief factor in constant surface cultivation, and—much as the gardener otherwise regards them—they therefore have some utility in imposing an operation that in other respects has so much value as we have indicated above. The seeds of weeds are constantly being carted on to the garden with manure, and more are also deposited there by wind, birds, &c., so that their destruction must ever be before the grower. The old saying that "one year's seeding makes seven years weeding" is particularly true in a vegetable garden. Seeds which are shed in one year do not always germinate the following season—some may be buried too deep, or where the conditions are otherwise unfavourable, but they retain their vitality for a long while, and will germinate so soon as they

are brought near the surface again, or when the conditions become favourable. For this reason it is always well to prepare land for a crop early enough to allow a short fallow before the seed is sown or the seedlings planted out; the weed seeds brought into favourable surroundings then have time to germinate, and can be killed off by shallow surface cultivation before the growth of the vegetables makes the destruction of the weeds more difficult. This practice will be found materially to reduce labour during the early growth of the crop.

Some crops, such as carrots, parsnips, &c., require a good deal of hand-weeding, but in most cases the cultivation between the rows can be done with a hand cultivator, which is much quicker than hand-hoeing. For other crops, which have more space between the plants in the rows, the weeding can be done by using small pointed hoes. Weeding between plants should be done before the cultivation between the rows, so that the latter operation may loosen the soil that has been compacted by the tramping to and fro, though where weeds have become numerous, the amount of hand-work can be considerably reduced by running the cultivator or hoe along between the rows before hand-weeding between the plants themselves is attempted; in the last case it will often be advisable to disturb the surface between the rows a second time after the hand-weeding is done. The best results from weeding are obtained by doing the work on hot sunny days.

Most weeds are killed by cutting them off just under the surface of the soil, but thoroughly to eradicate some—couch grass and sorrel, for instance—it is necessary to remove every underground particle, or to cultivate persistently and repeatedly until the roots die of exhaustion. Nut-grass can only be controlled by frequent cultivation.

Where irrigation is practised the drains and channels should be kept free from weeds, otherwise the seeds will fall into the water and be distributed over the whole area irrigated.

The greatest trouble from weed-growth is experienced on the coastal areas of the State, where the conditions are conducive to rapid growth—conditions, by the way, that are also most favourable for early crops of vegetables, and for the service of the metropolitan market.

MANURES AND FERTILISERS.

Although every attention be given to the working of the soil, it will be found insufficient to make available the large quantities of plant-food required for the production of so many crops in quick succession as the well-managed vegetable garden must carry, and fertilisers and manures must therefore be in regular use. On the other hand, however, no amount of manuring will produce good crops if the land is not well tilled. Fertility, indeed, depends on a happy combination of the two factors, and over both the gardener is the final arbiter.

The greater quantity of plant-food is made up of carbon dioxide (obtained by the leaves from the air) and water which is drawn up by the roots from the soil; the balance (about 2 per cent. only) also comes from the soil. Development depends largely upon a wonderfully delicate and elaborate process by means of which the plant makes use of both. Small though the proportion appears to be, the 2 per cent. is of the greatest importance, being made up of ten ingredients that are each quite essential to the growth of the plant. Most of these ingredients are present in almost all soils in superabundance, and as plants get enough of them for their requirements the

A Home-made Hand Seed and Manure Sower.

It consists of a small box with a funnel-shaped end through which either seeds or manure can be sown. A slide can be fitted to regulate the sowing of the smallest seeds.

cultivator need not concern himself about them. The exceptions are nitrogen, phosphoric acid, potash, and sometimes lime. Even of these, there is a plentiful supply in most soils, but not always in such a condition that plants can make use of it. The object of the gardener, therefore, should be to do all that he can to enable the supplies in the soil to become available, and where they are insufficient to enhance the supply by adding materials that contain them in some form readily available to the plants.

The proper manuring of crops had been greatly neglected in this State until within the last few years, and even now it is not unusual to hear doubts expressed as to the efficiency of chemical fertilisers; occasionally someone even

propounds the theory that their use tends to exhaust the soil. On the contrary, it is certain that any ordinary soil becomes impoverished by the constant removal of plant food by the crop, unless some means are adopted of maintaining fertility.

The materials required to keep the soil in fertile condition may be broadly classified thus :—(1) Manures that contain the necessary plant-food (principally potash, phosphoric acid, and nitrogen) ; and (2), vegetable matter and lime, which, besides containing plant-food, are of considerable value in improving the mechanical condition of the soil, and which thereby have a material effect in rendering available certain ingredients previously present in the soil, though not in a form in which plants could make use of them.

Manures that Supply Plant-food.

(*a*) *Phosphoric Acid.*—Manures containing phosphoric acid may be applied in the forms of bone manures (bonedust, bonemeal, &c.), superphosphate, and Thomas' phosphate.

Phosphoric acid is undoubtedly the plant food that can be most profitably added to the soils of the State—at any rate it is the particular plant-food that, when supplied in the form of a fertiliser, produces the most profitable response under our conditions. It is most commonly added to the soil here as superphosphate, that being the form in which phosphoric acid is most available to plants, and in which they can therefore soonest make use of it. Hence it is of special use where a rapid return is required, as in the case of spring-sown crops.

Superphosphate is usually applied at the rate of from 56 lb. to 3 cwt. per acre, the amount varying with the nature of the soil and with the quantities of other manures used in conjunction with it. This manure generally forms the basis of the "general manures," "special manures," "mixed manures," &c., on the local market ; such mixtures are usually prepared by the addition of sulphate of ammonia or nitrate of soda, and some potash salt.

Bonedust, another source of phosphoric acid supply, is also valuable for its nitrogen content. In place of superphosphate it may be used as a base for mixtures. It is, however, somewhat slower in its action.

(*b*) *Potash.*—Muriate of potash and wood ashes are the only forms in which potash manures are now obtainable. The former is a concentrated fertiliser and is chiefly used in mixtures. Until recently the main sources of supply of this particular plant-food were sulphate of potash and kainit, both of which are now unobtainable. The results from potash manures are not seen in our soils on the same scale as are frequently reported from other parts of the world, in fact, the present writers have never yet seen an instance of increased production from the use of potash manure alone, and therefore can only recommend its use as part of a complete fertiliser.

(c) *Nitrogen.*—Manures containing nitrogen are most required by crops that make a large amount of leaf growth, like cabbages, lettuce, etc., which are specially grown for their leaves, and in which quick growth and succulence are desirable. On the other hand it is not usual to employ these manures in connection with leguminous crops (peas, beans, &c.), as certain bacteria in the soil associate themselves with the roots of these plants, and enable them to make use of the nitrogen of the air in a way that other plants cannot. The best-known nitrogenous fertilisers are sulphate of ammonia, nitrate of soda, and dried blood. In the first two, the nitrogen is present in a form that readily dissolves in water, so that it is quickly available to the plant and produces rapid development of the crop. In dried blood, however, and in farmyard manure, bones, meat, &c., the nitrogen is not in a state in which it can be immediately utilised by the plant, but requires first to undergo some change while lying in the soil. Hence, dried blood should be added to the soil some time before it will actually be required by the plant, or in the case of a slow-growing crop it can be applied when the seed is being sown.

Sulphate of ammonia is the chemical fertiliser most used for its nitrogen content in New South Wales. In price it is cheaper than nitrate of soda, and contains a larger proportion of nitrogen. Neither of these manures should come in contact with the seed at sowing; they are better applied to vegetable crops as a top dressing, but on small areas like kitchen gardens about 1 oz. or 2 oz. can be dissolved in water and applied through the watering can. In such instances 1 oz. of the fertiliser per square yard would be a substantial dressing at any one time.

Generally speaking, however, nitrogen is supplied to vegetable crops in stable manure of which liberal quantities should be regularly added to the soil. The importance of this matter is of sufficient significance to be the subject of a separate section.

Manures that chiefly Affect Soil Condition.

In addition to the foregoing, which are chiefly used for the plant-food that they supply direct to the plants, there are manures that are more directly manures for the soil than for the plants. These are more related, of course, to the fertility of the soil and have therefore an important relation not so much to the immediate present as to the future.

Organic Manures.

The most effective means of supplying necessary plant-food to the soil and generally of maintaining fertility, is the addition of vegetable matter either in the form of stable or farmyard manure, or of compost manures. The processes by which the plant food contained in such materials is made available to growing plants, owe their efficiency in a large degree to the production of humus from the decay of the vegetable matter. It will not be out of place to discuss briefly, in the first instance, what are the functions of humus in

the soil and the best means of applying it. Humus (which is partially decayed vegetable matter) absorbs and retains moisture in the soil, and prevents surface evaporation. A surface soil fairly rich in humus, exercises much the same influence on the underlying soil as does a mulch of dead leaves or other vegetable matter. During dry spells, and under the influence of the hot winds usually prevalent under such conditions, the loss of moisture from the soil by surface evaporation is enormous, and in soils destitute of humus this loss is so rapid as to result in the drying up of the soil and the wilting of the crops. The final result of such conditions is the formation of scalded spots, and the complete removal of the fine surface soil in the form of dust.

The humus in the soil is the ingredient which is most subject to alteration and destruction. As soon as it has lost its moisture and become dry it is rapidly burnt out by the combined action of sun and air, so that it is exactly in those circumstances where its presence is most essential that it is most liable to destruction, and where the necessity of renewing it is most urgent. The presence of humus in the soil also tends to improve its texture by lightening it and loosening it, and preventing compaction of the surface. It is thus of special value in the amelioration of stiff soils. It is the principal source of nitrogen in the soil, and by its decay under the influence of soil organisms, ammonium salts and nitrates are produced, which are the forms in which this important element is assimilated by the plant.

From the foregoing it will be seen that humus is one of the most important of the soil's constituents, and any great variation in the amount present profoundly affects the value of the soil for cultural purposes. Indeed, the vegetable grower may well regard the addition of material that will in time increase the humus content of his soil as of much greater significance than the application of commercial fertilisers that will provide even a large amount of nitrogen, phosphoric acid, or potash.

In addition to humus content, farmyard and stable manures and street sweepings also contain appreciable quantities of these three important items of plant-food, but those quantities occur in such forms that they are lost or readily lose their value if the manure is exposed to the action of the weather for any considerable time. Proper treatment of the manure heap is therefore necessary prevent loss by leaching or by fermentation, and it is always better to put such manures in a compost heap. The material is then better prepared for incorporation in the soil, and weed seeds are destroyed before they have opportunity to germinate on the land.

The Compost Heap.

The compost heap is a most valuable adjunct to the vegetable garden, and it is a very great pity that it is not to be found more frequently even on the ordinary farm.

A heap or pit can be made very economically, and is of special value in that it utilises all sorts of vegetable and animal refuse, which would otherwise be wasted, and converts it into a valuable manure, rich in vegetable matter and eminently suited for intensive cultural conditions.

The principle upon which the compost heap acts is the fermentation of easily decomposed vegetable material in the presence of earth and lime. Not only are substances like peat and straw, which form the usual basis of compost heaps, thus decomposable, but almost every kind of organic substance, both of vegetable and animal origin, can be composted. Dead leaves, bush scrapings, weeds, tops and stalks of vegetables, as well as bone and animal refuse, can be treated in this manner. In the case of animal refuse the operation is much slower, and substances like bones should be crushed first. It is also important to be sure that animal refuse so treated is not derived from a diseased source.

The method of making and maintaining the compost heap will vary largely with local surroundings. As a general method of procedure the following will be found satisfactory:—Make a heap with alternate layers of earth, refuse, and lime. Under the term refuse is included all the waste material, either animal or vegetable, mentioned above. Cover the whole with a layer of earth. When a sufficient quantity of refuse is again collected, place it on top of the heap and cover with a layer of lime, and lastly of earth, until the heap is 3 to 4 feet high. The heap should be kept moist, and for this purpose all refuse water from the house, slops, urine, &c., should be added. The heap may be conveniently watered by making a hole into the interior and pouring the liquid in. The final covering with earth has the object of absorbing any ammonia which is evolved in the process of fermentation and by the action of the lime.

When the heap has been prepared it must be left for some time to allow fermentation to take place. Probably a few months will be sufficient, unless very refractory substances, such as bone, &c., are present. Then it should be well forked over and another layer of lime and finally one of earth should be added. In the course of another month or two it should be ready for use, and will provide an excellent manure, rich in humus, at a very slight cost. It will have utilised for the purpose a great amount of material that would otherwise be lost or burnt. When refuse material is burnt, the ashes, though still possessing manurial value on account of the lime, potash, and phosphates they contain, are of incomparably less value than the original substances out of which they are derived, owing to the absence of humus material and of nitrogen, which have been lost in the process of burning.

Instead of a heap the compost may be conveniently prepared in a pit. In either case the bottom should be cemented, or so drained that the liquid escaping from the mass can be collected and returned to the compost.

A second heap should be prepared while the first one is ripening, and being used. If it is desired to use superphosphate, potash, ammonium salts, and other more concentrated fertilisers, they may be mixed with compost manure before it is added to the soil. Used in this way greater benefit will be derived than if they were applied direct to the soil, and there will be less danger of leaching.

Poultry Manure.

Poultry manure, especially in poultry-farming centres where it is in fair supply, is valuable in the production of vegetables, and in sandstone country may be safely used with all classes of crops. For legumes (peas, beans, &c.), it is well not to use too much, as this family of plants does not require nitrogen to the same extent as the other plants.

Poultry-manure is the most concentrated farmyard manure, and care should be exercised in its application. The fresh manure should be used either as a top dressing or in the making of liquid manure. For digging in it is best composted with other garden refuse.

In applying poultry manure, a dressing of superphosphate or bonedust can also be given with advantage, more particularly on sandstone country.

Lime.

Plants require lime in small quantities only. The real benefit derived from liming is its action in sweetening sour and lightening heavy soils. The application of quick-lime requires great care owing to the chance of burning out the vegetable matter in the soil. Air-slaked lime, or carbonate of lime, is slower in its action and not so likely to exhaust the humus.

Liming with freshly-slaked lime is best carried out as follows:—Break the quick-lime (stone-lime) up into small lumps, place it in heaps about the garden and cover it with moist loam. Leave it thus exposed to the air and moisture until it begins to crumble to powder. As soon as this happens scatter the heaps with a shovel as evenly as possible over the surface of the ground, and harrow or rake it in very lightly. Liming is most effectively done in the autumn or winter, but whenever it is done the land should be left alone for two or three weeks after the application, and no seed should be sown nor any manures (especially such as contain nitrogen) used during that period.

Clay soils may receive a dressing of about 1 ton per acre, which is equivalent to about $\frac{1}{2}$ lb. per square yard. Sandy soils should not receive more than half this amount. Several light applications are more beneficial than one heavy one.

ROTATION OF CROPS.

In all parts of the world where intensive culture is carried on, the practice exists of changing crops each year and of growing them in regular succession to one another, and there is no class of produce with which this is more consistently done than with vegetables. All crops require very much the same plant-foods, but different crops require them in different proportions; some

feed only in the surface soil ; others draw their supplies from the deeper soil and subsoil. It is the business of the grower to take advantage of these variations in the habits and characters of his crops to ensure that the fertility of his soil shall at least be maintained, if not increased.

The supply of organic matter in the soil is much more easily maintained if crops of varying habits and purposes follow one another. Peas and beans, for instance, though grown only for their pods, produce a good bulk of top growth, which, when turned under adds humus to the soil. Roots and crops of the cabbage family, on the other hand, deplete the humus rapidly, and cannot be grown in successive seasons without a reduction in the fertility of the soil. Where large quantities of organic manures—stable or farmyard refuse or street sweepings—are easily available, this may be of less consequence, but to the grower whose supply is limited and who is obliged to depend largely on chemical fertilisers, it is very important that there should be maintained in his soil the proper proportions of decayed and decaying plant matter from which the soil bacteria can liberate fresh supplies of plant-food. Rotation, indeed, may thus be a means of saving considerable sums that would otherwise have to be expended on chemical fertilisers.

Some crops, such as peas and beans, have the power of obtaining nitrogen —the dearest of all plant foods—from the air, and storing it in their own systems and in the soil ; they are, therefore, doubly valuable in a rotation. Plants of this group are called legumes, and to the vegetable grower whose soil is of lower fertility than he might desire, they have a special utility.

Rotation has the effect, too, of controlling insect, fungus, and weed pests. The eggs and larvæ of the insect pests of a crop may remain in the soil to infest next year's crop if it is of the same or similar habits, while a complete change of crop may starve them out. In the same way, the spores of a fungus attacking a crop in one season may remain in the soil, and find easy prey next year if a similar crop is on the same ground.

One suburban gardener some years ago approached the Department, asking why his potatoes were diseased—they were so every year now, he said, though some years ago he got good crops of healthy tubers on the same ground. Inquiry elicited that he grew potatoes in the same spot each year, peas on the same trellises, cabbages in the same rows. When urged to change his crops round, he objected to the work of moving the trellis, &c. ; but it was not until he complied with the advice that he got better results. His method of growing the same crop year after year on the same patch was simply carrying disease forward from one crop to the next, and though the potato patch was the first to show the effects, the pernicious principle was also at work on the other patches.

The preparation of a soil for a crop of a different class, as well as the absence of the natural food, may destroy the larvæ or young, or kill the spores, and thus keep the pests in check. Much the same applies to weeds, the seeds and the seedlings of which are much more likely to be destroyed if the land is not devoted to the same crop year after year.

The effect of change of crops is to enable the soil to be cropped more continuously, and to produce a greater bulk of material from a given area. On valuable land the grower must get a second—and sometimes a third—crop in one season, and this can only be done where a rotation is systematically practised.

Judgment and experience are necessary to the determination of a really satisfactory rotation, a succession perfect in all respects being exceedingly difficult to arrange. It must be remembered that some crops—apparently very different from one another—are really closely related, and subject to the same pests. The turnip is cultivated for its root, but it is of the same genus as the cabbage, and neither should follow the other. Nor do potatoes and tomatoes appear very much alike when viewed from the point of view of their products, but botanically they are closely related, and subject—in particular—to the same fungus diseases, so that land that has carried potatoes that were affected with Irish blight, will not be cleaned up by planting tomatoes next year.

Summed up, it may be said that short-season crops should be followed by long-season ones, shallow rooters by deeper rooters, and residue-producing crops (for turning under) by heavy-feeding crops. Only by foresight, and a careful record of what is done with each block year by year, can such a programme be successfully carried out.

IMPLEMENTS AND EQUIPMENT.

The farmer who is growing cabbages or cauliflowers, or root crops like turnips or carrots, on a fair scale, is able to employ horses in the preparation of the land, and even in the inter-cultivation of the crops, but the production of a large number of vegetables in a small area necessitates the use, almost exclusively, of manual labour, and the equipment required will therefore vary accordingly.

Specialty vegetable growing is generally carried out in conjunction with some other branch of farming, and implements, such as the plough, harrow, roller and cultivator, are already part of the farm plant, so that only a few smaller implements, suited to the requirements of the particular crop in question, will require to be added.

For intensive culture, the following list should cover the implements required :—Spade, shovel, pick, fork, pronged hoe, dutch and chipping hoes of various shapes and sizes, rake, hand seed-sower, cultivator, trowel, tape measure, garden line and reel, manure fork, wheelbarrow, knife, brushes, baskets, watering-can, buckets, hose, spray-pump, sieve, shears, dibber, axe, tomahawk, scales, and packing needle. A certain number of tools for repairs will also be required, such as hammer, chisel, wrench, punch, saw, square, brace and bits, and a plane.

THE PROPAGATION OF VEGETABLES.

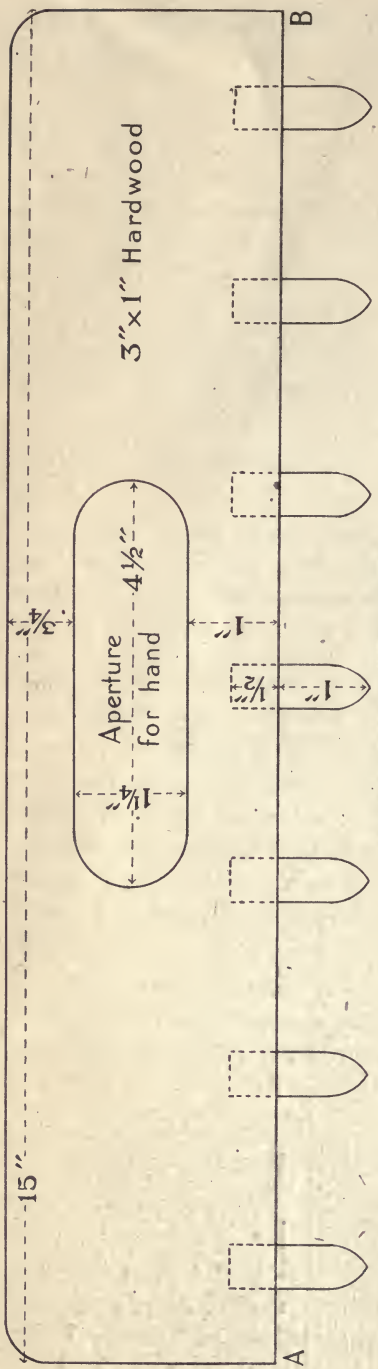
Although some vegetables are propagated from root pieces or cuttings, the majority are started from seeds.

There are various methods of raising plants from seeds, which differ considerably according to circumstances. New South Wales covers a very wide area and a variety of climatic and other conditions, and it is impossible to lay down a method in relation to any vegetable crop that is likely to prove satisfactory everywhere. On the other hand, it is impossible here to describe the methods of every district in detail, and all that can be done is to indicate certain principles that are of general application, and then to advise each intending grower to familiarise himself with the practice of the successful men in the district in which he intends to start operations.

The conditions that must be present to ensure germination of seeds may be stated as warmth, moisture, air, and light. The last is not actually essential to germination, but it is of importance as soon as the young plant is above ground. The first two conditions are obtained by a thorough preparation of the soil or medium in which the seed is sown, and under certain conditions by the direct application of heat and moisture.

In the field it is not always possible to secure ideal conditions for sowing but by following good cultural methods it is possible to help considerably in bringing about germination. In the first place it is necessary that the soil be brought to a fine tilth, so that moisture conditions can be controlled. After sowing, it is usual to firm the soil over the seed by rolling, in order to bring about capillary connection with the under soil, allowing moisture to be drawn to the surface where it is of use to the seed. This simply means that the soil moisture is being rapidly lost by evaporation, and it is therefore necessary that, as soon as germination has taken place, a surface mulch should be established where possible. As most seeds are sown in drills, this mulch can be quickly created by intertillage. In the case of seed that is sown deep, such as peas and beans, the surface can be broken up after being compacted by using a brush or light harrow.

Field sowing in large areas is usually done by using horse-drawn machines. For example, the ordinary wheat drill is often employed for the sowing of peas. Hand seed-drills that will sow most kinds of vegetable seeds are also obtainable, and are particularly useful on a commercial vegetable growing area. In small gardens the drills in which small seeds are sown are made by drawing the rake or hoe handle along the soil, or by using a garden hand scriber, made on the lines of the accompanying illustration, the depth of the drill depending on the seed to be sown.



A Hand Scriber for Marking Rows.

This implement is chiefly useful in the seed-bed, but it can be enlarged and fitted with a handle for field operations. Holes are drilled 2 inches apart, and pegs inserted at any desired interval from 2 inches to 12 inches apart, and rows marked out with them.

The scriber may be made on a larger scale and fitted with a handle, if such is desired, and where deeper drills are required than the pegs make, the marking will serve as a guide line, to be followed with a hand or wheel hoe. If the first drill be struck with a garden line, the use of a scriber ensures that all succeeding drills will be straight and evenly spaced.

The depth to sow depends on a number of conditions, but as a general rule is three or five times the diameter of the seed. Where conditions as to moisture can be controlled, shallower sowings can be made. During the heat of summer it will be necessary to plant deeper, in order to ensure the seed being placed in the moist soil.

The Gardener's Seed-bed and Seed Boxes.

The cultivation of some varieties of vegetables is carried out with better results when the young plants are raised in seed-beds. Under this system it is possible to bestow greater care upon the plants, and so to encourage quick growth. Indeed, there are certain crops that are so delicate in their early stages that their production is only possible when seed-beds are used for their propagation. This is because it is impossible under field conditions to prepare such a satisfactory medium for germination of the seed as is necessary. Given those conditions in a seed-bed or group of seed boxes, it is possible

to ensure plants of strong growth with good root development, such as are likely to yield a better and bigger crop than when raised wholly under field conditions. Seed-beds allow of the greatest possible use being made of all garden land, as plants can be raised in readiness for transfer to the garden as soon as other crops have been harvested.

The soil medium used in the seed-bed or seed boxes should be carefully prepared by mixing decayed leaf mould or manure from the compost heap (it is better if sifted) with some good garden loam and a little sand. Such a soil will hold moisture well, and is light enough to offer no resistance to the young plants when germinating. The addition of the mould and sand will produce a large root development, which is of considerable importance in the growth of the crop after it has been transplanted.

When the prepared soil (which should be moist) is placed in boxes, it should be pressed down, care being taken that the edges and corners are well filled. The boxes should have openings in the bottom to allow of drainage; shallow boxes are convenient.

To sow the seed, whether in boxes or larger beds, make very shallow drills—merely impressions—across the surface of the soil, and sprinkle the seed evenly along the drills. For light seeding the seeds should be picked up between the finger and thumb, and slowly dropped with a rubbing movement. Then shake a little prepared soil over the surface, and press down firm with a block of wood. A little dry horse manure that is free from weed seeds can then be sprinkled on the top, to prevent caking and to act as a mulch. Cover the box with a sheet of newspaper or a bag until the plants begin to appear, this being the means of retaining heat and moisture. Once the plants are up, the boxes or beds will need careful watching, and should be watered as occasion demands. The watering should be done with a very fine rose and very lightly, so as to prevent the washing of the soil from the roots and flattening of young plants. The boxes should be on a level base, so that the effects of watering are uniform.

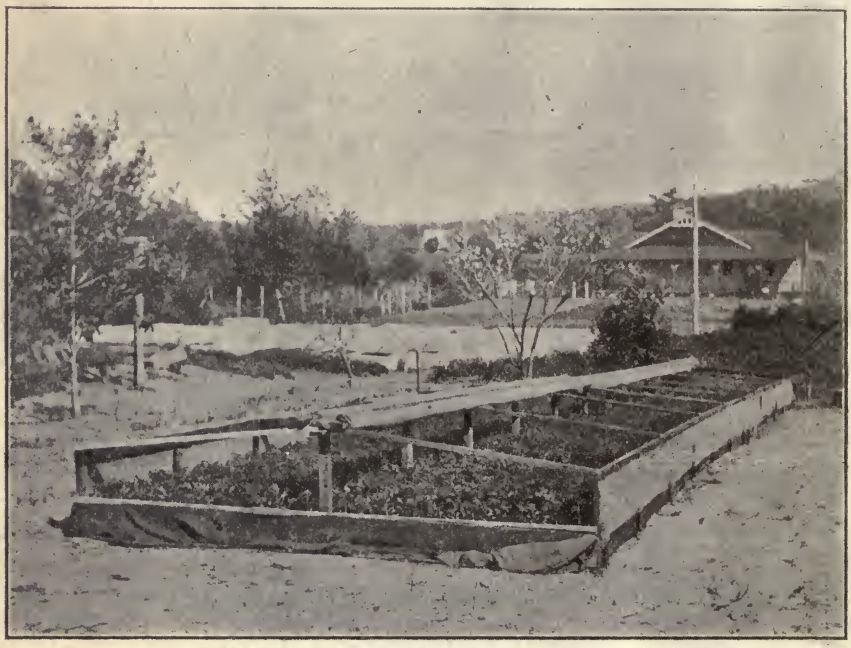
Certain plants, such as melons and cucumbers, which do not transplant readily, are sometimes raised in paper pots or veneer bands, or jam tins prepared for the purpose. Full details of the methods are given in connection with watermelon culture on page 59.

Hot-beds and Cold Frames.

In order to secure extra early crops, hot-beds and cold frames must be resorted to. In many of our coastal districts there are localities where frost seldom occurs, and it is therefore only necessary during the cooler weather to use a cold frame with a glass cover to secure early plants.

A cold frame is a simple structure, with either a glass or a cloth top. The only source of heat in such a case is the sun, and the structure is simply for the purpose of preventing rapid radiation of heat during the night. It is useful for mild climates, such as exist on the North and Central Coast, and is of particular use in hardening off plants which have been raised in hot-beds and which are about ready to be transplanted. A modified form employed by the household gardener consists of a pane of glass placed over the seed box

A hot-bed is similar in structure to a glass-covered cold frame, but it is supplied with bottom heat, either by fire flues or fermenting manures. The usual method of applying the heat is to make an excavation in the ground

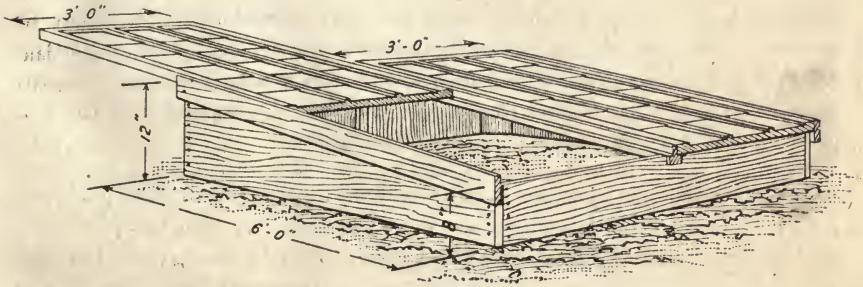


A Suitable Type of Cold Frame.

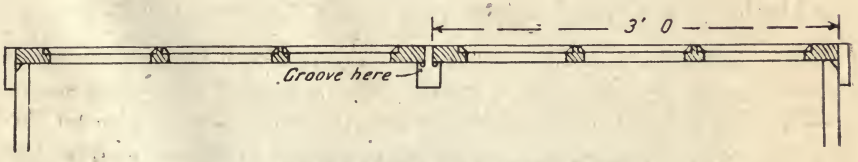
about 2 feet deep, and to fill it with fresh stable manure which is thoroughly tramped down during the filling. The frame (see illustration on page 29) is then placed over the manure, which is allowed to heat until the temperature reaches its highest and begins to subside. A light covering of soil is put over the manure, and on top of this the prepared loam in which the seed is to be sown. Instead of spreading the loam on the manure in the hot-bed, it is suggested that seed boxes or "flats" be used and the plants raised in these. They can then be easily transferred to the cold frame for hardening, and later to the field for transplanting. If the original seeding has been too thick, the young plants should be thinned out to allow of full development. Seeding

too close produces lanky plants. The thinning may be done when the plants are in the first rough leaf by pricking out into other prepared seed boxes or pots.

The watering of seedlings in the hot-bed requires careful judgment. The mistake most commonly made, especially during the early stages, is the application of too much water. It is most important that air should be admitted throughout the day by lifting the sash sufficiently high to allow the necessary ventilation. During windy weather very little opening of the sash is needed, and then only on the side opposite to the direction of the wind. As the plants grow it will be necessary to hasten the hardening-off, and more air should be given each day until the plants are hardy enough to be removed to the cold frame, where they will remain until fit for planting in the open.



Perspective View of Glass Frame for Hot-bed.



Section through sashes of above, showing construction.

No doubt many suburban growers have often wondered why tomato plants that looked so well when purchased from the city shop failed to grow when planted out. Probably the plants were removed direct from the hot-house to the shop without being subjected to any hardening-off.

In the tableland districts, where the temperature is colder, hot-beds are of considerable use in obtaining early supplies for local requirements, though it is evident that these districts cannot produce early vegetables for metropolitan markets in competition with districts where the season normally favours early production.

Owing to the difficulty of obtaining supplies of fresh stable manure for production of bottom heat in hot-beds, other measures are sometimes necessary. A plan now in use in some districts is that a square ship's tank (400 gallons) is fitted with an iron grating about half-way down and a small opening made at the bottom of one side. The seed boxes filled with soil are placed on the grating, and a coke fire lighted in the bottom, the seed being sown when the soil has reached a temperature of 60 degrees Fah. In a case like this it is necessary to exercise great care in the amount of heat applied at the time of sowing and after.

Transplanting.

In order to allow of as little check to growth as possible it is well to give every attention to the preparation of the land that is to receive the plants. The soil should have been recently stirred to rid it of weeds and to render it reasonably loose. Before transplanting, the rows should be marked out in readiness. On small areas a garden line will be found most useful. For the household plot a board (say 8 or 9 inches wide and of any convenient length) is useful to stand on, in order to prevent too great a compaction of the soil and the unsightly footprint holes between the rows.

If weather be unfavourable it will be found best to retain the plants in the seed boxes until the conditions are more suitable. If possible, plant just before or after rain, or during cloudy weather. Should the days be hot and the plants too far advanced to be left in the boxes, the latter part of the afternoon should be chosen for the work, so that the cool of the night may afford an opportunity for the plants to establish themselves. On small areas it is possible to provide some form of shelter against frost and sun, such as small bushes, brackenfern, pieces of boards, or even hessian coverings.

In providing this frost-proof shelter it is a convenience to place the stake on the southern side, and then to arrange the hessian or other material to cover the plant completely at night, but so that it can be lifted up on the northern side in the morning, and the plant exposed to the sun without the southern portion of the shelter being lifted at all. This arrangement saves the work of removing the whole covering every morning and restoring it in the evening.

A quite effective protection against frost can be provided by covering the plants with wrapping-paper or a couple of thicknesses of newspaper, and using clods to keep them in place during the night.

Only the strongest plants should be used; those of inferior growth, and any that have been damaged should be discarded. The seed-boxes should be saturated some time previous to the removal, in order that the plants may retain as much earth as possible about their roots when being

separated from one another. When the plants have been removed to the field sprinkle them lightly with water to prevent too great loss of moisture by transpiration, and keep the roots sheltered from the heat of the sun. In the case of well-grown leafy plants—such, for instance, as cabbages—it is advisable to cut or twist off about one-third of the leaf-ends before planting, so that too great demand will not be made upon the roots while they are establishing themselves. If the soil that is to receive the plants is dry, each plant should receive a quantity of water when being set out.

The best tool for transplanting is a dibber, which is simply a short, pointed hardwood stick of a little more than the thickness of a broom-handle, and 6 or 7 inches long. When pressed into the soil a hole is made, into which the roots of the young plants are put. The soil is then tightly pressed down with the fingers or dibber, and the surface subsequently loosened to form a mulch. The plants should be planted deep enough to ensure the roots coming in contact with moist earth, and in summer it is best to plant a little deeper than was the case in the seed-boxes. When planting large areas the work is expedited if the workers are divided into teams of three—two planting and one dropping the plants just ahead of the two planters. Spread out the roots of the young plants so that they will come in contact with as much soil as possible. Machines for planting vegetables have been used in this State, but do not appear to have created a favourable impression.

A Crop of Broad Beans in an Orchard.

Vegetable Crops.

In this section, a number of vegetables that are commonly grown in New South Wales are dealt with in detail. In some cases the cultural methods are discussed under the heading of one plant, and are not repeated under other plants of the same class, so that the reader will sometimes find it more convenient to read the longer article in conjunction with the one on the subject he wishes particularly to refer to. Thus the fullest information on the growth of the cauliflower will be obtained by reading the article on that subject in conjunction with the one on the cabbage.

Sections are also devoted to diseases and pests and methods of controlling them, and attention may be directed to the monthly planting calendar at the end of the book.

ARTICHOKE (GLOBE).

This plant is a totally different one from the Jerusalem artichoke. It resembles a very strong-growing thistle, and the head is the edible portion; only the thickened base of the flower scales and the bottom of the flower being eaten. When cooked it has a flavour somewhat resembling asparagus.

The plant, which is a perennial, requires a very rich soil such as is obtained on alluvial flats or on drained peaty swamps. If grown on upland soils, it will be necessary to give a heavy dressing of decayed organic matter and a good deep working.

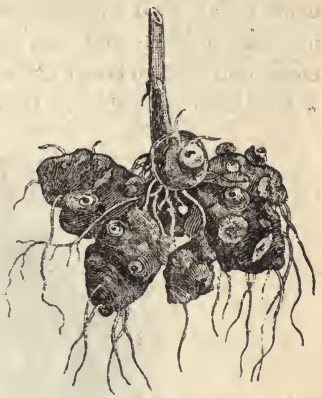
It is usually propagated by transplanting suckers, but plants may also be raised from seed. The removing of the suckers from the original plant requires care, and it is necessary to detach with each sucker a little of the root from the parent plant. For this purpose a sharp knife is necessary. All the suckers should not be taken from the original root, as some are needed to produce a crop in place of the old plant when it has died down. The suckers are planted singly, 4 inches deep in rows, with 2 feet between the plants and 4 feet between the rows; or they may be set in groups of three. They should be set in firmly, well watered, and shaded from the sun until established. The heads must be cut while still young and tender, or they will become hard and unattractive.

After the heads have been harvested in autumn, the top growth should be cut down and the plants given a dressing of stable manure. The soil between the plants should be kept cultivated throughout the summer. It is necessary to renew the beds at least once every three years, though under very favourable conditions they can be made to last longer.

ARTICHOKE (JERUSALEM).

This plant belongs to the sunflower family and grows to a height of 6 to 9 feet, resembling closely in appearance an ordinary sunflower with a miniature flower. It produces a large cluster of rhizomes or tubers useful for culinary purposes. (See accompanying illustration).

The Jerusalem artichoke is very persistent in growth, and, if raised in suitable soil, is difficult to eradicate. Enough tubers, as a rule, are left each year to continue the crop; hence it is wise to set apart a permanent spot for it—odd corners or waste places of little value for other crops. It is a crop that requires little attention once it is established, and is extremely hardy. While the best crops are raised on good mellow loams, profitable yields are secured on stiff clay, light sandy or gravelly soils; the land is best suited where the drainage is good. In fact, any soil suitable for potatoes will answer for artichokes, but needs thorough cultivation.



A cluster of rhizomes.

The tubers are planted by dropping them into furrows 3 feet apart, with a space of 2 feet between each tuber. If the sets are small plant whole; large ones may be cut. Cover by turning a furrow over them. About 4 cwt. of tubers will plant an acre.

The cultivator should be kept moving between the rows to conserve moisture and keep weeds in check.

The crop matures in about five months, and after flowering when the tops droop and die, about April or May, it is ready for harvesting, but should only be dug as required. In frosty situations the tops should be left as protection to the tubers which decay quickly if attacked.

ASPARAGUS.

Asparagus is a branching herbaceous plant, attaining a height of 5 to 6 feet. It is a perennial, possessing a large root-stock and fleshy roots, in which it stores nutriment to tide it over the winter. It is upon the vigour of this root-stock and root system that its value depends, for these send up, upon the return of warm weather, quantities of young sprouts, which are used extensively as a vegetable. Its period of most active growth is during the summer, it being dormant throughout the winter.

What are considered to be several distinct varieties are found among the edible species.

These are probably the result of differences of soil, climate, and culture. Of the varieties grown at Bathurst Experiment Farm, Connover's Colossal and Pride of Brunswick have proved the best. Erfurt Giant, Giant Dutch, White Mammoth, and Camden Park have also been tried. Among market gardeners the most popular varieties are Connover's Colossal, Palmetto, and Barr's Mammoth.

The Soil and its Preparation.

Asparagus can be grown on a variety of soils, in fact any that can be made into a good garden loam. It thrives best upon sandy loams which are moderately deep and rich in vegetable matter. River-flat lands that are moist and well drained are considered ideal. Heavy clay soils, and those with a hard pan, or any that are cold and wet, should be avoided. Soils

The root-system of a plant of Asparagus—eight years from seed.

containing stones are undesirable as they interfere with the cutting and cultivation. As asparagus requires all the sun it can get, the land should have a northerly aspect, and should not be shaded by trees and shrubs. The crop responds well to irrigation.

Soil which has been worked deeply, manured heavily with farmyard manure for root crops, and kept free from weeds, is most desirable. The land should be subsoiled to the depth of from 18 to 20 inches, unless it is loose and friable to that depth: the old method of trenching to the depth of 24 to 30 inches is not practicable in field culture, nor is it necessary. Asparagus is a deep-rooting plant where the conditions are favourable; the roots of the 8-year-old plant in the accompanying illustration had gone to

the depth of 4 feet 4 inches. The land should be thoroughly worked during the autumn, left to mellow during the winter, and should be again ploughed and drilled ready for the reception of the roots in the early spring.

The raised bed method, as generally practised in garden culture, is not to be recommended under Australian conditions, and is only permissible where an abundance of moisture is ensured. The flat field culture has much to recommend it.

Raising the Plants.

Fresh seed should be sown in spring in well prepared soil, in rows 2 feet apart and about 4 or 5 inches apart in the drill. The seed germinates slowly, and if previously soaked in warm water for twenty-four hours germination will be hastened. Cover about 1 inch deep. The land should be well worked and kept free from weeds. By liberal treatment vigorous yearlings are produced. In setting out, care should be taken not to expose the roots to the sun or drying winds. It should be done just prior to their new growth in the spring.

Only strong-growing plants should be used. Select those that have the thickest, most succulent and vigorous stems. Choose tall rather than shrubby plants. Vigorous yearlings are much to be preferred, but if 2-year-old plants are used, only those with imperfect flowers which do not bear seed should be selected; seed-bearing is exhausting.

Planting Out.

As the beds or fields will, with proper care, last a life-time, it is important that the planting out be done carefully, and sufficient room be left for root expansion. In rich, moist soils, drills should be made 4 feet apart each way, and the roots set in their intersections. In light soils they may profitably be made 5 feet each way. This allows of cultivation both ways, which is a consideration in the eradication of weeds and conservation of moisture. The drills should be opened out about 9 inches deep and the roots set in the bottom, care being taken to keep the crown upward, and to spread the roots in their natural positions. The crown should then be covered by 2 or 3 inches of soil. If "blanched asparagus" is required, the crown should be placed about 6 inches below the surface, and if "green asparagus," planting should be shallower. The natural growth of the crown forces it towards the surface, and the original depth can be maintained by applications of abundance of farmyard manure. The drills are levelled by cultivating towards the plants.

A French Method.

A more economical way of establishing a bed, however, is that known as the French method, the seeds being sown in the field at once, and the work of planting out saved altogether. The system is as follows:—

After the land has been ploughed and cultivated, strike out furrows from 5 to 6 feet apart, according to the richness of the soil. The ploughing should be deep—up to 12 inches if possible—and it is preferable to plough

twice in the one drill, throwing a furrow each way from the centre of the row. Then work a single-horse cultivator (closed up) in the bottom of the furrow, to loosen the soil in the bottom of the drills.

Make hills 20 inches apart in the furrow, mixing the soil in each case with a shovelful of well-rotted, fine manure. Sow four or five seeds in each hill, and cover lightly with good soil. The hills should then be watered and kept moist until germination, which will take about three or four weeks. After germination the plants should be thinned out, leaving only the strongest plant in each hill.

Keep the soil loose and free from weeds, and, as the plants grow, apply well-rotted manure and soil, a few inches at a time, round each. The filling-up goes on steadily (care being taken not to choke the plants) until the drills are filled.

After-treatment.

After planting out, the land should be kept free from weeds throughout the summer, and frequently cultivated to conserve moisture. When the stems turn brown they should be cut down and either carted off or burned on the beds or fields. The land should be thoroughly cultivated, and where possible a liberal application of well-rotted farmyard manure applied; this can be more economically applied during winter than in the spring. Early in the spring the land should be again thoroughly cultivated, and any artificial fertiliser used should be applied then.

The summer cultivation must be continued each year, as it is most important. During the summer months the plants are preparing fresh stores of food in their roots, and require liberal treatment; neglected plants are longer in becoming remunerative. In the autumn the stems should be cut off before the seeds fall, as asparagus seedlings are one of the worst pests. Where practicable, it would be wise to go through the plants and cut out all seed-bearing stems rather than cut the whole. Later, the bed should be treated as during the first year.

Cutting.

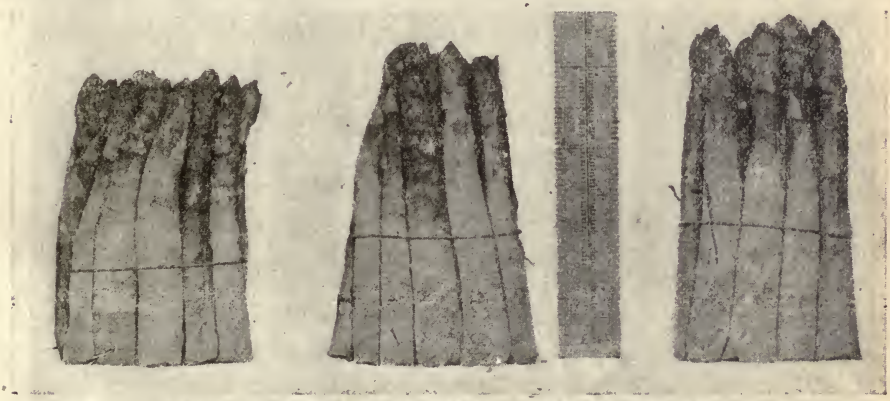
Old established roots can be cut for about ten weeks before being allowed to run up to stem and leaf. Younger roots must be cut lightly and it is better not to make a cutting till the fourth spring. Throughout the cutting season the small as well as the marketable shoots should be cut clean away; otherwise they exhaust the roots, and reduce the marketable output. The field should be gone over and the shoots cut each day, as the leaf-buds, which form the tip, should not be allowed to open before cutting.

The method of cutting varies with the demands of the market. If "blanched asparagus" is required, it should be cut when the tops show above the ground, and about 8 or 9 inches below the surface; this system necessitates the earth being ridged over the crowns. In cutting, care should be taken not to injure other ascending shoots. For "green asparagus," the

shoots are cut when about 7 inches high, cutting about 2 inches below the surface. An intermediate method is to cut when about 4 inches high, and about the same distance below the surface; the product is then half white and half green. In this State green asparagus is the most popular. After cutting, the stalks should be subjected to as little exposure as possible in the fields. When the dirt has been rinsed off, they should be tied into bunches with raffia, fibre, or string. If for local market, one string is sufficient; if to travel any distance, two are preferable. The stalks should be graded into different qualities. A bunching appliance will be found useful in preparing for market. If the bunches are to be kept over night, they should be dipped in clean water and stood on end upon clean straw which has been thoroughly wetted.

Manuring.

Asparagus, to be profitable, should be forced, and quick-growing, succulent shoots should be aimed at. To ensure these, the manuring must be liberal. Large quantities of farmyard manure mixed throughout the lower layers of



Average bunches of Asparagus grown at Bathurst Experiment Farm.

the soil are not necessary, excepting when required to ameliorate heavy soils. Fifty or sixty tons of well-rotted farmyard manure to the acre is a fair dressing, and can be applied most economically after the stems are taken off in autumn. It should be well rotted previously, to destroy seeds of weeds. Applications of commercial fertilisers should be made in the spring, directly after the cutting is finished, and prior to cultivation. Applications of the following manure have given good results upon many soils :— 250 lb. nitrate of soda, 400 lb. superphosphate, and 150 lb. muriate or chloride of potash, per acre.

Common salt is now but little used by commercial growers; the application of such manures as nitrate of soda and chloride of potash has to some extent taken its place. Salt is apparently of more use for keeping weeds in check than as a plant manure.

Asparagus culture has proved a profitable side-line to orcharding in the Goulburn district—one grower, Mr. F. Stone, getting a particularly good return. The asparagus is planted in single rows midway between the rows of trees, and the beds are now a few feet wide. The asparagus is cut in the morning, and graded, bunched, and packed during the afternoon, so that the produce is on the Sydney market early the following morning. The bunches, when tied, are tightened by pushing in a few extra sticks, and are then placed upright in shallow trays of water, in order to keep them fresh; each bunch is carefully scrubbed clean with a brush before packing. When packing into boxes, moistened paper is placed at the butt of each bunch, and each layer of bunches is separated by a sheet of moist paper; consequently the asparagus arrives at its destination in a very fresh condition.

A prolific Plant.

The growth from a 14-year old plant. The earth has been scraped away to show the number of shoots since the two days previous cut.

A considerable quantity of asparagus is grown in the metropolitan district, chiefly in the vicinity of Mascot, where the soil is of a sandy nature. The crop is also grown in the Gosford and Camden districts with good results.

At Mascot the asparagus is planted in single rows either 3 feet or 4 feet apart, but those distances are considered too close when the plants are fully grown, and do not allow of earthing up. As the roots cover a wide surface a large number of shoots are eventually found in the pathways. A better distance to plant is 5 feet. Usually the pathways between the beds are filled with long-strawed stable manure to prevent evaporation. The beds are given an application of salt occasionally.

The cutting of the grass is done with an asparagus knife (usually home-made), which consists of a few inches of saw-edge on the end of a knife-blade. A small bread-saw with the end 2 or 3 inches filed and given a fine serrated edge, acts admirably.

In this locality the bunches, after having been tied with home-grown New Zealand flax, are made tight by placing a large butt of asparagus, cut wedge-shaped, into the end of the bunch. This is a practice that should be discouraged in favour of tightening with full sticks. The best "grass" is tied with two bands. The use of raffia, strips of New Zealand flax, or tape is recommended, as giving a better appearance than binder twine.

Duration of Beds.

As an instance of the lasting qualities of the crop when properly tended, it may be mentioned that a small bed of this crop belonging to Mr. Edward Twynam, of Goulburn, is still bearing heavily, although it was an established bed when Mr. Twynam purchased the property in the year 1868. This makes the bed now at least fifty-two years old.

On the other hand, the Chinese growers at Mascot cut the crop for too long a period each season, and do not allow sufficient top growth for recuperation, with the result that the beds remain in cultivation for only a few years.

Diseases and Pests.

Asparagus rust (page 92).

BEANS.

There are a number of species of beans, all of which can be grown in this State. The best known are Broad beans, Kidney or French beans, Haricot beans, and Lima beans. The first named, which is grown for the seeds, does best in the cooler portions of the State, or in warm districts as a winter crop. The Kidney or French beans are esteemed for the edibility of their pods, and can only be grown in the warm seasons of the year, being very susceptible to frost. Lima and Haricot beans are grown for their seed, but must be treated as summer crops.

The crop is influenced to a considerable extent by the quality of the soil, a light, shallow soil giving much inferior returns to a rich alluvial one. Bean plants of all kinds respond readily to dressings of manure, those most beneficial containing phosphoric acid and potash. As with all other legumes, there is little necessity for nitrogenous manures, but some advantage in the use of lime. The crop has long been known to farmers as an excellent soil-renovator, and it is particularly valuable in a rotation.

Farmyard manure cannot always be used with advantage in connection with beans, its application, particularly on heavy soils, being apt to produce too much leaf growth at the expense of the crop of pods.

Kidney or French Beans.

The seed should be planted in rows 3 feet apart, and from 3 to 6 inches apart in the rows, according to the quality of the land, the thicker sowing being made in the richer soils. They should be covered to a depth of 2 inches. The usual practice is to strike out shallow drills with a plough, and then to drop the seed by hand at the intervals named. The covering can then be done with an ordinary light harrow. Some growers have had a special plate made to fit the maize planter, and sow their seed in that way. The plate requires to be a very thick one in order to save the grains from being cracked. Under ordinary conditions, from ¾ bushel to 1 bushel of seed is required per acre. Seed may also be sown with the hand seed sower.

Low-lying situations planted to beans require attention as regards drainage. If this is neglected, the plants become yellow in colour in wet periods or seasons. The cultivator should be used as often as possible, until the plants are tall enough to be hilled with the plough. If the weather is dry, or a heavy downpour of rain comes, the cultivator can again be used to advantage, breaking the crust, and also checking any weeds that might spring up after rain.

On land that does not answer to the description "low-lying," the cultivation can be confined to intertillage between the rows with a cultivator of an ordinary type.

In frost-free situations such as are met with in our coastal districts, sowings can be made during the winter months, whilst on the Tablelands it would be risky to plant before the end of October.

Successive sowings can be made until just sufficient time is allowed to enable the crop to mature early enough to miss the first frosts of autumn.

Harvesting must commence as soon as the pods are of sufficient size, and should continue at frequent intervals. If they are allowed to become too ripe, not only is that particular picking spoiled, but the cropping power of the plant is considerably reduced. The pods are usually forwarded to market in full chaff bags, and delivery must be effected as quickly as possible, in order that the produce may reach the market quite fresh.

There are many varieties of exceptional merit, which may be divided in three classes, as follow :—

Stringless.	*String.*	*Butter.*
Bountiful.	Canadian Wonder.	Brittle Wax.
Stringless Green Pod.	Early Refugee.	Kidney Wax.
Byer.		Pencil Podded Wax.
		Startler Wax.

Runner Beans.

This class of bean is grown under similar climatic and soil conditions to the French bean, though not on such an extensive scale. It is usually sown in rows and staked, and in gardens it is very useful in covering fences, thus occupying the minimum of space. As a support for these tall varieties, wire-netting is often stretched on posts erected along the rows, with a strand of plain wire to prevent sagging.

In very warm districts, however, wire-netting is apt to become too hot on days when the sun shines bright and clear, and the vines suffer in consequence; for such conditions wooden stakes must be recommended. Another common method of growing beans of the climbing class is to put stakes along each row, sloping them towards each other in pairs of rows, so that as the beans grow they climb the stakes and intermingle at the top, each pair forming a pyramidal mass. Under conditions so favourable as to light and air, large quantities of pods are produced, and can be conveniently gathered. Some vegetable gardeners even make use of a couple of pairs of such rows to afford shelter from winds for more tender crops.

The planting and cultivation in the early stages is similar to that suggested in connection with the dwarf variety.

The Runner bean that has been most popular in recent years is the Epicure, which is a heavy cropper, producing its bean in clusters. If the picking is constant, the plant will bear throughout the summer months, and almost until frost or cold weather cuts it back. Kentucky Wonder is a variety that can also be strongly recommended. Scarlet Runner is largely grown by small gardeners.

Broad Beans.

This crop requires heavier land and a better supply of humus and of nitrogenous manure than the other classes of beans, its growth, in most districts, being chiefly made in the winter months. Very good results have been obtained on heavy clay soil by ploughing fowl manure under during the early preparation of the land.

Sowing generally takes place during the months of March, April, and May, though in cool districts the seed is often sown in February.

The method usually adopted is to strike out drills about 3 feet apart in well-prepared land, and to drop the seeds in the rows about 6 inches apart. The seeds which are large, should be covered fairly deep—not less than 2 inches. As evaporation is slow in the winter, broad beans do not usually require so much intercultivation as the summer beans. They form fairly strong-growing plants, and if planted in places sheltered from wind should not require any support.

When the plants begin to flower the tops should be pinched out to promote the setting of pods. The crop is ready for gathering as soon as the seed is large enough, but before the "eye" turns black. The whole pod of the Broad bean may be used for slicing in the same way as the French bean, provided the pods are pulled when young. The crop is not grown extensively, its chief recommendation being its winter habit.

Broad Windsor is the variety most favoured in New South Wales, but the long pod varieties are earlier and more prolific. The best of these are Leviathan, Seville, Early Long Pod, Aqua Dulcie, and Exhibition.

Lima Beans.

There are dwarf and climbing varieties of lima beans, and of these, the former return the higher yields.

As a vegetable, the seeds are used either fresh or kept for winter use in the same manner as haricots.

Planting should not take place before the ground has become warm : these beans do particularly well under fairly warm conditions but will not stand frost. The best results are obtained by placing the seed with the eyes down, in drills 4 feet apart for runners, and 3 feet for bush varieties. In the rows the runner plants should be thinned to about 4 feet apart and the bush varieties to 6 inches. Of varieties, the best runners are King of the Garden, Leviathan, and Giant Podded, and the bush varieties recommended are Burpees Improved, Bush Lima, and Fordhook Lima.

Haricot Beans.

This class of beans, like the preceding one is largely imported, but there is no reason why we should not produce locally the whole of our requirements. The crop has already been grown successfully under the supervision of the Department at Mittagong.

The method of cultivation is much the same as with French beans, except that the green beans are not the object, the crop being allowed to mature its seed. The late sown crops (approximately January and February in milder localities) are generally the more profitable, as the beans from early sowings are subject to the attacks of weevil.

Diseases and Pests.

Anthracnose or pod-spot (page 91); leaf spot (page 102); mildews (page 103); pea-spot (page 104); rust (page 107); sclerotium disease (page 108).

Aphis (page 110); eelworm (page 118); French bean fly (page 120); pseudo-looper moth (page 123); tomato and bean bug (page 124).

Bean and pea seeds are attacked by weevils mentioned on page 126.

BEET.

Beet-root is a favourite summer vegetable. It can be grown almost anywhere and on practically all soils, but those of a heavy, clayey nature are the least suitable, and good crops of best quality cannot be expected under those conditions.

Beet has a tap-root, and requires deep working of the soil. Very rich soils are not altogether suitable, as with this crop extra large roots are not popular. For the same reason it is well not to over-plant too early in the spring, as if not quickly used, the roots become too large before the season is over. Smaller successive sowings will be found to answer requirements much better. The seed can be planted throughout the year, except during the cold, wet, winter months. For good quality, the crops should be quickly grown, as otherwise they become somewhat tough, woody, and coarse flavoured.

The position should be a sunny one, and, for household plots, rows 12 inches apart are sufficient. For commercial culture the rows should be spaced not less than 15 inches apart, and even up to 30 inches. The seed as purchased is fairly large and has a corky appearance; this is really the seed fruit which contains several seeds. The germination is sometimes disappointing, but this is mostly due to faulty sowing. Should the surface soil be dry and light in texture, the seed must be planted deep in order to reach the moisture, but if damp, a depth of about 1 inch is sufficient. To get the moisture through the corky covering of the seed is always very difficult, and to overcome this it is usual to soak the seed overnight previous to planting. Where possible the seed should be spaced about 1 inch apart in the drills and thinned to at least 4 or 6 inches apart, according to the variety. When young, the plants can be transplanted if carefully handled so as not to interfere with the roots, but this course is only recommended where there are wide spaces in the rows as the result of faulty germination; the plants from the thicker portions of the field may then be utilised for this purpose. The crop needs little attention other than cultivation to keep down weeds and a sufficient supply of moisture. The roots can be used for household purposes as soon as they are large enough, but they should not be forwarded to market until more fully developed. In marketing, neither roots nor tops should be trimmed.

Great care must be exercised in harvesting, as bruising or breaking of the tap root is a serious drawback, causing bleeding to take place in cooking, which leaves the vegetable very pale in colour. The beet is rich in sugar, and if allowed to bleed a large quantity of this constituent is also lost. In cooking, if the utensil is large enough it is always advisable to allow the tops to remain, but if the vessel will not permit of this, screwing off the tops is preferable to cutting them.

The long varieties are not favoured by housewives on account of the difficulty of accommodating them in ordinary pots; for this reason the turnip-rooted sorts are more popular. Varieties recommended are:—Eclipse, Egyptian, Crimson Globe, and Electric.

Silver Beet or Silver Spinach.

This is a variety of beet-root, the leaves of which have been developed for culinary purposes. The cultivation is identical with that of ordinary beet, except that the plant should be spaced at a distance of not less than 15 inches apart. The leaves are used as required, and are boiled and minced the same as ordinary spinach.

Plants are raised in boxes or seed beds and transplanted to the garden. The leaves are pulled from the plant throughout the summer, those showing a broad fleshy midrib being the most suitable.

Diseases and Pests.—This vegetable is attacked chiefly by the same diseases as cabbage, &c. For full list see page 47.

BORECOLE OR KALE.

These plants belong to the cabbage family, but do not form a heart the loose fleshy leaves being pulled from the stem as required. The mild flavour of most varieties commends this vegetable to many. Providing the leaves are regularly pulled, the plants are productive over a long season, and diseases and insect troubles, such as aphis and "fly," do not trouble them so much as they do other plants of the same family. The cultivation is similar to that for cabbage (see below), and the best varieties are Sutton's A1 and Green Curled.

Diseases and Pests.—See list attached to cabbage (page 47).

BROCCOLI.

This vegetable is a hardy strain of cauliflower, and should receive the same cultural treatment (see page 48). It is very slow in maturing, however, and under conditions of intense cultivation, quickly growing crops like lettuce or certain varieties of turnips are frequently interplanted to make full use of the ground during the first few months. The best varieties are Adam's Early White, Late White, Veitch's Self-Protecting, and Walcheren.

Diseases and Pests.—See list attached to cabbage (page 47).

BRUSSELS SPROUTS.

This vegetable is looked upon as a delicacy, and consists of small heads (like miniature cabbages) formed at the junction of the leaf and stem. The plant belongs to the cabbage family, but requires a longer season of growth.

Planting is done during the spring and summer months, and the crop is therefore only suited to localities where water is available during dry periods. The cooler parts of the State are best suited to its culture; in the warmer parts the plant is usually affected by aphis.

The small heads should be gathered when of sufficient size. The heads on the lower part of the stem become mature first, and as these are harvested those higher up the stem become fit for use. The sprouts should be severed from the plant with a knife and not broken off; it is then possible to obtain a second crop. The small heads may be marketed in punnets.

The cultivation is similar to that of the cabbage (see below).

Diseases and Pests.—See list attached to cabbage (page 47).

CABBAGE.

In spite of the fact that cabbage growing is carried out on large areas in favourable districts in New South Wales, sufficient supplies are not produced to satisfy the demand throughout the year; and other States place large quantities on our market.

If the market was not subject to gluts, cabbage-growing would be a highly remunerative undertaking; as it is there are many who are doing well, even though they have to cart the crop many miles to the railway.

This vegetable has, perhaps, a wider range than any other, being more or less successfully grown in practically every district in the State. It is essentially a cool-climate plant, and when grown in the hot districts must be planted so as to mature before the heat of summer. Nearly any soil will grow cabbage successfully if sufficient manure and decaying vegetable matter are added to keep it in good physical and chemical condition. Alluvial soils and those of basaltic formation will, however, be found most suitable.

The soil should be worked deeply, and any stable manure or compost well worked in. Should any slow-acting artificial manures, such as bonedust, be used, it is advisable to work half the quantity into the soil some weeks ahead of planting.

Good seed is of the utmost importance. Most commercial growers are fully aware of this fact, and grow selected strains for their own requirements. Good seed should give a 90 per cent. germination, and should not be kept for more than three years after harvesting. As there is little difference between one and two-year-old seed, it is advisable for the grower to buy his supply of seed one year in advance. This allows of a small portion being planted, so that its relative value may be gauged one year in advance. Two or three ounces of seed is more than sufficient to supply plants for one acre.

Raising the Plants.

The best method of raising plants is to sow the seed in drills in the seed-bed, allowing about four inches between the rows. Plants raised in this manner are usually sturdy, and differ from the lanky plants obtained from beds where the seed has been thickly broadcasted. The seed should be sown thinly, and each ounce of seed should sow a length of about 200 feet.

The seed-bed should be about 4 feet wide, and should allow of half being weeded from each side. A bed large enough to produce plants for one acre when seed is broadcasted would be 20 feet long and 4 feet wide. It is always advisable to put in sufficient seed to raise more plants than are actually needed. This allows for loss by pests, faulty germination, and the transplanting of healthy plants only.

The young plants should not be forced in the seed-bed and should receive plenty of light so that stocky plants will be produced.

Under ordinary conditions plants should be ready for transplanting in six weeks from sowing, cooler weather conditions taking a little longer. If possible choose a dull day to carry out this work : should the weather be hot it should be done either early in the morning or late in the afternoon and the plants given some protection by means of light bush or fern covering.

Distance of Planting.

The distance of planting varies according to the variety used. For the smaller varieties, such as St. John's Day, 2 feet 6 inches x 2 feet is sufficient, and for larger sorts, as Savoy and Succession, 3 feet x 2 feet. If the soil is of poor quality the plants should be given more room, and should be planted 3 feet x 3 feet. When planted at this latter distance on rich soils there is a tendency for the plants to become too large.

Manuring.

Soils supplied with an abundance of vegetable matter, such as alluvial deposits, do not need heavy manuring, even though the cabbage is a gross feeder and requires a liberal amount of all plant foods, specially nitrogen. The supply of farmyard manure generally being limited where cabbage growing is extensively carried out, resort has to be made to artificial mixtures containing a high percentage of nitrogen.

A mixture of blood, bonedust, and superphosphate in equal quantities, supplied at the rate of not less than 6 cwt. per acre together with a top dressing of sulphate of ammonia or nitrate of soda, at the rate of 1 cwt. per acre, is productive of good returns. In top dressing, the manure should be applied just before the heads begin to form.

Harvesting.

When the heart is fully developed and does not yield to pressure from the hand, it is ready to harvest. It is not advisable to allow the mature crop to stand during frosty or wet weather owing to the danger that the hearts will crack and quickly spoil. When harvesting cabbage the whole plant should be pulled up and the stump removed. If left in the ground the stump produces fresh growth of no commercial value and robs the soil of plant-food.

Varieties.

Succesion (*Henderson's*).—This is a very popular variety, and the one most grown. It is fairly early, has large flat heads, closely packed, carries well, and is a favourite on the market. It stands the heat of summer fairly well, and does not run to seed quickly. The best all-round variety.

St. John's Day.—This is one of the best varieties for hot climates. It is very early, produces a firm heart, and is a small cabbage.

Improved St. John's Day.—This is the best of summer cabbages and is altogether distinct from the small St. John's Day, being somewhat later and larger.

London Market.—This is a good main crop variety for autumn planting.

Early Jersey Wakefield.—An early sort, and largely grown in small gardens. It has a very pointed heart, and should be cut as soon as ready for use, otherwise it will run to seed.

Drumhead.—Earlier than Succession, and a good summer cabbage.

Danish Allhead.—Large, firm headed, and a suitable winter variety.

Copenhagen Market.—An early, quick-growing variety.

Savoy.—This is a very crinkled type of cabbage, having a very dark-green colour and a distinct flavour. It is especially suitable for the cooler portions of the State, and is planted in February so as to mature during autumn and winter, the flavour being considered best after exposure to frost

Pickling Cabbage.—The cultivation of this class of cabbage is identical with that for the other varieties. Most of these are red in colour.

Diseases and Pests.

Black leg (page 93); black rot (page 93); club-root (page 97); downy mildew (page 99); white rust (page 109).

Aphis (page 110); cabbage grub, or diamond-backed cabbage moth (page 115); cutworm (page 114); eelworm (page 118); Rutherglen bug (page 123); slugs and snails (page 124).

CAPE GOOSEBERRY.

A perennial plant, grown for its berries, which are produced on the new season's growth. This plant is also known as the husk tomato.

The plants are raised in seed-boxes in the spring, and are afterwards transplanted to a distance of about 4 feet x 3 feet. The crop is easily grown, and the plant is a prolific bearer of berries, which are produced inside a papery husk. The Cape gooseberry is a plant that will not stand frost, but if pruned back at the conclusion of the season, and well manured, the heaviest crop will be obtained in the second year.

On account of their small size, the harvesting of the berries is a costly operation, and consequently they are sometimes allowed to fall on the ground before being gathered up. The fruit is useful for jam-making, preserving, &c.

CARROT.

The carrot is one of the most easily grown vegetables, but is not cultivated in this State to the extent that it deserves. It is especially suitable to the householder with a small allotment.

Almost any soil can be brought into a fit condition to grow this crop, but a deep, sandy loam is best. A fine tilth should be produced, and care must be exercised in the manuring. Farmyard manure should not be incorporated with the surface soil just prior to planting, but a plot may be selected which had been well manured for some previous crop. Artificial fertilisers will prove beneficial, especially on poor soils. A mixture of superphosphate or bonedust, and sulphate of potash, in the proportions of four parts of the former to one of the latter, should give satisfactory results when applied at the rate of two or three cwt. per acre, but the quantity required depends of course, on the richness of the soil. Artificial manures, in conjunction with a plentiful supply of water, result in early maturity and crispness—the latter being a most important factor.

The soil should be deeply tilled to allow of the full development of the roots, and early preparation of the land is recommended. The rows can be sown fairly close—usually from 12 to 15 inches apart. This permits of the use of hand wheel hoes for cultivating. The seed can be sown either by hand or by means of a hand seed-drill, planting to a depth of about half-an-inch. Fresh seed should be used and may be mixed with sand to allow

of a uniform sowing—the seeds have a tendency to stick together on account of being slightly hooked. After sowing the seed should be firmed in and then the soil loosened on the surface. If the germination is good it will be necessary to thin the plants lightly to prevent wedging, and as the roots develop the larger ones should be removed as soon as they become large enough for use. By this means the usefulness of the bed is also increased. A spring sowing should provide carrots fit for use from a few months after planting right on throughout the winter. The spring sowings are the most satisfactory, as the plants become properly established before the hot weather is experienced. Sowing can, however, be carried out during the summer months, and with proper care and attention to watering and cultivation, good crops may be obtained. 4 lb. of seed are required to sow an acre.

The harvesting is a simple matter where the soil is of a light texture, the crop being very easily pulled out of the ground. But should the soil be at all compact or hardened or the carrots very long, it will be necessary to loosen the soil with a fork or by ploughing a furrow alongside the row. The crop is usually marketed in bunch form, but may be sold loose by the bag. For the best returns it is advisable to wash the roots before selling.

For the earliest crop, and on shallow soils, the shorthorn type (Early Horn or Early Nantes) is preferred; for main crop, and on deep soils, the longer varieties are best suited, namely, Intermediate, Altringham, Danvers, and Manchester Table.

During the cool months the roots may be stored by pitting in sand something after the method of storing potatoes in pits. It is usual to cut off the top growth before heaping.

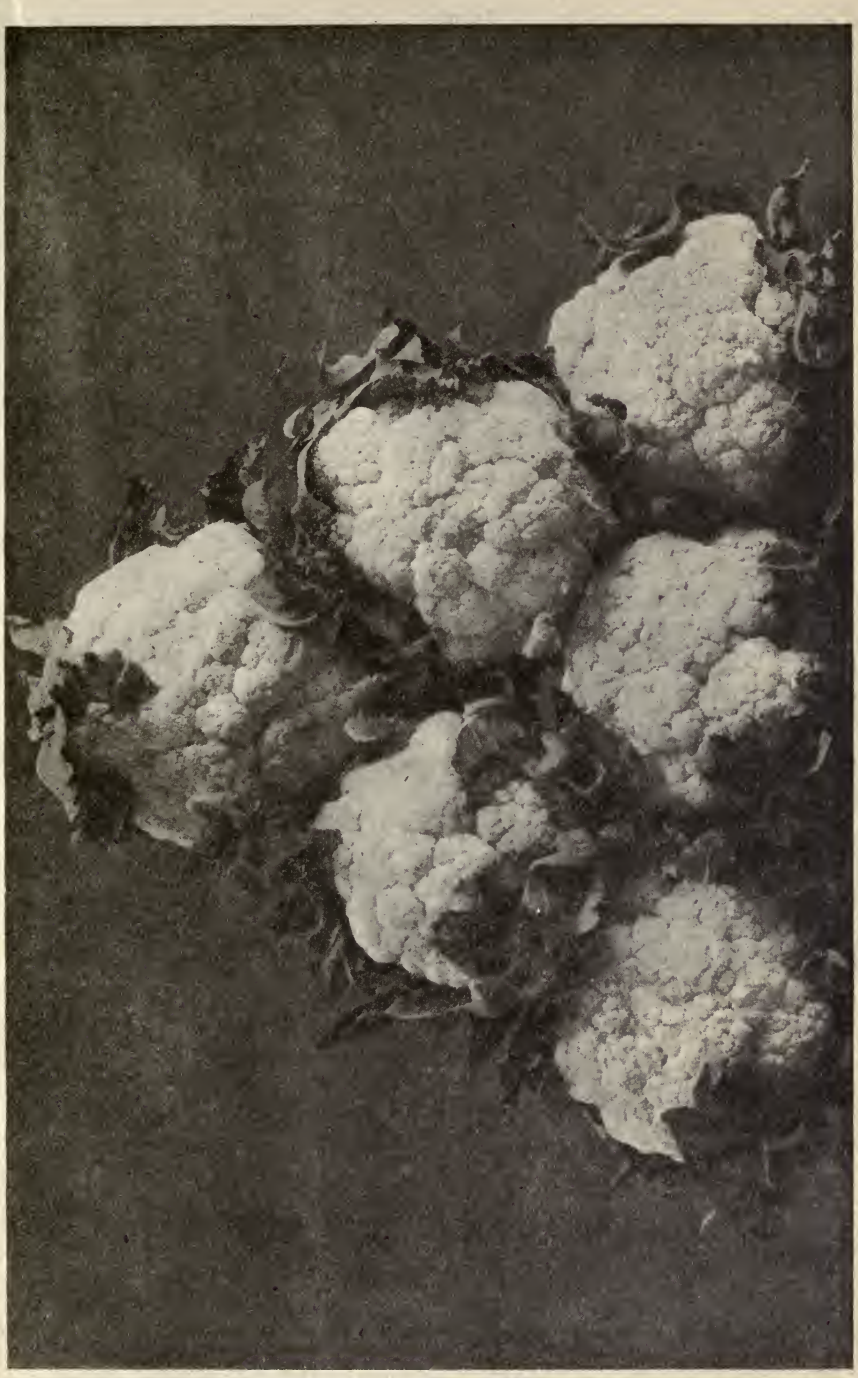
A local firm is now drying carrots and it may pay growers to test the field culture of the crop for this purpose.

Diseases and Pests.—In general this vegetable is subject to the same attacks as cabbage, turnip, &c.; for list see page 47.

CAULIFLOWER.

Although belonging to the same family as the cabbage, the cauliflower is not grown to nearly the same extent. This is due chiefly to the necessity for more favourable conditions during the growth of the plant than are required by other members of the same order.

The cultural directions given for the growing of the cabbage (page 44) will also be found generally applicable to cauliflower growing, with the following additions:—The main crop should be planted from December to February, and the plants should be set 3 ft. x 2 ft. 6 in. apart, late varieties requiring a distance of 3 ft. x 3 ft.



Cauliflowers grown by Mr. T. Kook, "Rock Mount," Inverell.
Watered by natural rainfall only. Weight, 20 lb. each.

Tying.

Owing to the difficulty of determining whether or not the plants are ready for harvesting the practice of tying the outside leaves over the flower to protect it from weather influences, is seldom adopted by commercial growers. Some growers use a different coloured band each day, so that when examining for fitness for market they can pick out the mature heads by the various coloured bands. This method is a satisfactory one if the development of the heads is even.

It is very important that the flower should be kept clean and white. While the head is small it is well protected by the young leaves surrounding it, but when the coral head begins to grow rapidly it must be covered in some manner to protect it from sun and frost. This is usually accomplished by breaking off some of the largest outside leaves and placing them amongst the other leaves so as to properly cover the head, or it may be done by bending over some of the larger inner leaves.

Cauliflowers in the field, cut and ready for carting.

Harvesting.

As soon as any of the plants become fit for harvesting examination of the field must be made daily, and heads must be cut before they show signs of the flower stalks breaking away, thus giving the head an uneven, loose appearance.

The cutting is usually done with a large knife, the plants being cut about 3 inches below the head, keeping all but the outside dirty leaves to avoid damage in transit. The plants when cut, may be carried to convenient heaps round the field, or, if the waggon or cart can be taken through the crop without damaging the growing plants, they may be loaded direct.

The weight of cauliflowers, as marketed, varies with the size, ranging from fifteen to twenty dozen per ton.

Varieties.

Veitch's Autumn Giant is undoubtedly the chief variety grown. It is a late variety, with a long stem and large undulating dark leaves. The head is large, very white, and well covered by inner leaves.

Dwarf Erfurt (also known as Early Erfurt or White Queen) is an early variety, and is practically the only variety grown by the Long Island (U.S.A.) growers. It is a plant of medium size, producing a fairly large, solid, heavy head of good shape.

Snowball.—This variety is a good early sort, and is much favoured in the Goulburn district. It is a little earlier than Dwarf Erfurt, but not equal to it in quality.

Early London.—A fairly early variety, grown largely in the metropolitan gardens.

Diseases and Pests.

In general, cauliflowers are subject to the same attacks as cabbage (for list see page 47).

CELERY.

Celery is best suited to the cooler districts, where it is possible to grow two crops in the year. Good results are also obtained in the warmer areas, but in these parts it requires to be planted so that the main growth is made during the cooler months. In the tableland districts, hot-beds are necessary in raising seedlings for the spring planting; for summer planting the seed can be sown in the open.

The crop requires the richest of soil, not only in mineral plant-foods, but also in organic matter. In the United States of America, where thousands of acres are planted with this vegetable, peaty swamps are drained and used extensively for the purpose. In ordinary garden soils it will be found necessary to trench and apply liberally large quantities of compost (decayed leaves, sod, &c.) and stable manure. On heavy clay soils it is useless to attempt the culture of this crop unless previously drained, or the raised bed system adopted. On newly-drained swamp lands and also on clay soils, a dressing of lime at the rate of 1 ton to the acre is beneficial. This application should be made some months previous to the planting.

The usual method of planting is to sow the seed in seed-boxes, where the plants are allowed to grow until they attain a height of 3 or 4 inches. The tops should be then clipped back—an operation again repeated at a later date, to produce strong, stocky plants. At transplanting it is advisable to shorten the root growth.

The seed is extremely fine, and takes a considerable time (usually about a fortnight) to germinate. From three to four months are required from the time the seed is sown until the plants are ready to transplant.

There are several methods of field culture, namely, trench, level, and level beds or new celery culture. The main difference in these systems is the method of blanching the crop.

Trench-planting.—In this system the furrows should be set out at a distance of 4 feet apart, and the plants put in at a distance of 6 to 8 inches in the trenches. The bottom of the furrows should be loosened and given an application of stable manure, and the furrows made wide at the top, so that the earth will not fall into them and cover the young plants. On large areas the double mouldboard plough will be found most useful in making the trenches.

The blanching is done by gradually filling up the trenches as the plants grow, allowing them to attain a height of 1 foot before commencing to earth up, and taking care that no soil gets into the heart of the plant. As the plants develop further bankings can be made. This operation should always be carried out in dry weather.

Level-planting.—By this method the crop is planted on the ordinary soil level and allowed to grow to its full height, before commencing to blanch. The blanching is done by means of boards placed along each side of the rows when the plants are high enough to show their tops above them. The boards should be about 1 foot wide, and in lengths of 12 to 14 feet. They are held in position by means of stakes driven into the soil, and by slats nailed across the tops of the boards so as to leave 3 or 4 inches between them at the top, and a slightly greater distance at the bottom. Where the crop is blanched in this way the rows are planted at a closer distance—usually 30 inches to 3 feet apart, and self-blanching varieties used.

Level Bed or New Celery Culture.—This method of planting consists of setting the plants very closely in beds, usually about 6 to 8 inches apart each way. The beds are made long and narrow, not more than 6 feet wide, so that they may be weeded from each side. Under such intense culture exceedingly heavy manuring is necessary, and liquid manure should be applied occasionally. The plants, when partly grown, form one dense mass, totally shading the soil in the centre of the bed. Towards maturity, the outside of the beds are boarded up so as to totally exclude the light, and if the plants have been well grown it will be found that they are as well blanched as if grown in single-boarded rows.

It is usual to allow from two to three weeks under both the boarding systems for the blanching. Other means such as drain pipes, small casks and paper bands are applicable to small gardens.

When properly blanched the plants can be lifted as required, and after any discoloured outer stalks have been pulled off the roots should be trimmed and washed, and the head tied into bunch form.

Celery is a crop that must not receive a check in its growth, and for this reason low-land soils, where the water table is not far below the surface, are suitable for it.

Varieties.

White Plume.—Is largely grown all over the world ; it is characterised by its silver-white colour.

Solid White.—Is a vigorous grower with fleshy, tender stalk, which becomes yellowish-white on blanching ; one of the best.

Golden Self-blanching.—This is one of the best favoured varieties ; its stalks have a golden tint, and are easy to blanch.

White Pascal.—One of the best winter varieties ; blanches a deep golden yellow.

Celeriac or Turnip-rooted Celery.—This variety of celery is grown for cooking purposes, such as flavouring soups, &c. The plant is allowed to make free growth, and no trouble is taken to blanch it. The root becomes enlarged, and although stalks are formed they are hollow and bitter, and unfit for table use.

Diseases and Pests.

Aphis (page 110) ; celery leaf spot or leaf blight (page 102) ; early blight (page 100) ; eelworm (page 118).

CHILI OR CAPSICUM.

Chilies are easily grown, especially in the coastal districts of this State.

The crop is treated in much the same way as tomatoes, that is the seed is planted in seed-boxes or beds, and the plants transplanted. Plant in rows 3 feet apart with 2 feet between the plants in the row. Sandy loams and river flat lands are particularly suitable.

The pods are used for seasoning, pickling, and for the flavouring of drinks. The dried fruit, chiefly of the Bird's Eye variety, forms the base of cayenne pepper.

The large varieties are milder in flavour and are used for culinary purposes, especially when filled with finely-chopped meat or other substances, and served baked or stewed.

Bird's Eye and Long Red are the varieties chiefly used for pickling, and Chinese Giant, Neopolitan, and Ruby King, those used for culinary purposes.

CHOKO.

The choko is a quick-growing climbing plant somewhat resembling the cucumber, but much more prolific in growth and yield.

The plants are raised from sprouted fruits in the spring, and though at times slow to start, once established in our warmer climates, they will last for many years although annually cut down by frost. The best position for planting is one where moisture is abundant, such as near a drain, and it is best to support the vines by a trellis or fence. One plant should yield sufficient fruits for the requirements of the household.

There are two varieties which are of equal value—White and Green.

CRESS.

There are two types of cress—land-cress and water-cress. The land-cress is a very fast growing crop and is utilised as a salad plant—usually in conjunction with mustard (see page 64).

Small sowings should be made at regular frequent intervals if a constant supply is desired. The plant runs to seed quickly, and must be used in the early stages. During hot weather it should be grown in a shady position; for household purposes it is best cultivated in a seed-box.

The crop is most easily grown, and the soil need not be very rich, in fact wet sand or moss have been successfully used. Where ordinary soil is used, a strip of hessian is sometimes placed over the surface of the soil, well watered, and the seed sown on the hessian. This is done to keep the crop clean.

After sowing, the bed is usually covered unti germination commences which may be within twenty-four hours after sowing if the temperature and moisture requirements are favourable. The crop is cut for use when about 2 inches high.

Water-cress, as the name signifies, is an aquatic plant, and the crop is usually grown in running springs or creeks.

The plant may be propagated by rooted cuttings or by sowing seed. In the latter case, the seed being very fine should be mixed with sand, and sown in trenches which are kept constantly moist. When the seedlings appear, the trenches may be slightly flooded just sufficient to cover the plants.

CUCUMBER.

The most favourable conditions for the production of cucumbers are a rich sandy loam and a frost-free situation. The soil should be deeply worked, and a liberal supply of well-rotted stable manure thoroughly worked into the hills, which should be placed about 6 feet apart. Plant about eight seeds per hill and later thin to the three strongest plants.

To produce early cucumbers for the Sydney market the seed should be sown in June or July, in a warm corner with some bottom heat, or in tins or squares as in the case of melons (see page 59), and when danger of severe frost is over the plants should be transferred to the warmest situation available and protected by covering at night. The plants should be mulched and well watered if the weather proves dry, and as high winds are prevalent in the spring the vines should be secured in position by means of pegs, so that they will not become matted and twisted together.

The fruit should be gathered as soon as large enough and before any signs of ripening are exhibited in order to allow of the development of the younger fruits. For market the fruit should be carefully packed in layers, separated by fine dry straw, in cases having a capacity of about a bushel, and constructed so as to admit air.

In addition to the demand for cucumbers for salad there is a market for cucumbers for pickling; in this case earliness is not so important, but the crop is harvested at a much younger stage. It is advisable before planting, to arrange a contract with some pickle manufacturer, as otherwise it might prove difficult to place the produce when it is ready.

The varieties that do best in this State are Apple-shaped (most suitable for private gardens), Long Green Prickly, White Spine, and Commercial (all popular in the Sydney vegetable market), Gherkins (a small variety grown chiefly for pickle), Fordhook Pickling, and Small Green Prickly (both good pickling sorts). Guada Bean, a plant recently under public notice and much boomed, is a species of cucumber but of little value.

Diseases and Pests.—See list attached to pumpkin (page 74).

EGG PLANT.

The cultivation of this plant is very similar to that of the tomato. It can be grown in most parts of the State, but the period of planting is governed by the seasons. As the plant is susceptible to frosts planting is not usually made until late spring, when the seed is sown in seed-boxes, and the plants transplanted as soon as they attain sufficient size. For transplanting the plants should be spaced 2½ to 3 eet apart in rows 3 feet apart. Too many fruit should not be allowed to form on the plant at any one time, and when they are setting it will be found advisable to pinch off the extremities of the branches, thus ensuring larger fruit. As the crop ripens it is advisable to mulch around the plants to retain moisture, and to prevent the fruit from becoming damaged by resting on the ground.

The varieties recommended are New York Purple, Early Long Purple., and Black Pekin. There are white varieties, but they are not so frequently grown as the coloured sorts.

Diseases and Pests.—The diseases of this plant are chiefly those common to the tomato (see page 89).

ESCHALOT OR SHALLOT.

The eschalot—or shallot—is a plant of the onion family, grown for flavouring, and eaten largely in its raw state. Single bulbs or cloves should be planted about 5 or 6 inches apart during the late autumn or winter months. If to be used green it is lifted when of sufficient size, but if required for use at a later stage it may remain in the ground until the tops die down in the autumn, then lifted and allowed to dry, stored, and used as required.

Diseases and Pests.—See list attached to onion (page 67).

GARLIC.

This plant is grown for flavouring purposes, but is otherwise of little culinary use.

The soil and cultivation requirements of garlic are similar to those of other crops of the onion family. It is propagated either by planting bulblets or cloves 6 inches apart in rows 1 foot apart, or the whole bulb envelope, which consists of about ten cloves, is planted at distances of 1 foot apart. In either case planting should be very shallow, and may be carried out during the autumn or winter. Small Red is the variety desired by sauce factories.

GRAMMA.

See Pumpkin (page 73).

HERBS.

All herbs do exceptionally well in this State, and every householder should have a few plants of the more important sorts, even if he confines his operations to growing them in pots. All garden soils will be found suitable for the purpose. Those plants that are propagated from seed should be raised in the spring, but where only one or two plants are required it would be an advantage to buy rooted plants.

For marketing, the tops are either bunched and sold green, or they may be dried and the leaves separated, in which condition they are in most demand. Large quantities are annually imported in this dried state, but as there is a protective duty of 4d. per lb. on imports there is considerable scope for local growers.

Mint.—This perennial plant requires a situation where there is a constant supply of moisture, such as a creek bed, &c., where it will spread very rapidly. The method of propogation is by rooted plants, these quickly send out underground roots, which can be divided and used for extending the bed.

As grown in suburban gardens mint is harvested green and sold in bunches.

Oils distilled from varieties of mint have high commercial values (spearmint £1 per gallon, peppermint 15s. to 18s. per gallon). One local firm alone requires annually a quantity equal to the product of over 100 acres; at present outside sources are depended on for supplies.

English or black mint is the best of the peppermint varieties, and spearmint is of a lighter green colour, and longer in the leaf.

Marjoram.—This plant is easily grown from seed, and lasts for many years.

Parsley.—The seed of this herb is very slow in germinating, and better results are obtained by sowing in a seed-box containing good quality soil, and transplanting to the field when the plants are very young, as they form a very long taproot. Fresh plants should be raised every year.

Sage.—This herb is more in demand than any other in its dry state. The plant is easily grown from seed, or it may be propogated by root division, and when established will last for years. Besides the ordinary variety, there is a giant form known as Mammoth, which has proved of merit.

Thyme.—This herb is easy of cultivation, and may be propagated from seed or by division of the plants. The two varieties chiefly grown are Broad Leaved and Lemon Scented.

The gathering of herbs for drying should be done in the height of summer, just as they are about to bloom, as at that time the plants are at their best as regards their essential oils. Drying should be carried out immediately after gathering, under partial shade or in an oven—factors necessary to preserve colour and flavour. After rubbing the leaves off store in air-tight receptacles.

HORSE RADISH.

This plant does well in moist situations. It is propagated by rootlets or pieces of root, and plantings should be made every year to maintain a supply of useful roots. If large roots are required deeply-worked ground is necessary. The root pieces are planted in a slanting, almost perpendicular, position, in rows 2 feet apart and about 1 foot apart in the rows. Planted in spring the roots may be used the following autumn; larger roots require a longer season. If propagated by seed, sowing should take place in March or April and the crop treated as an annual, being ploughed or dug the following winter. If allowed to grow as perennials in the same spot the plants are apt to become troublesome as weeds.

As a culinary vegetable its pungent taste is appetising, and in addition to its use in a raw state it is employed in making mixed pickles.

KALE.

See Borecole (page 44).

KOHL-RABI.

Kohl-Rabi or turnip-rooted cabbage is grown to a limited extent only in this State; its cultivation is similar to that of ordinary cabbage. The edible portion of the plant is the swollen, turnip-shaped, stem that forms just above the ground; this is ready for use about two months after transplanting. For home use the leaves may be boiled and served like cabbage.

Two plantings may be made—the first in spring, and the second about January or February—to mature in late autumn or early winter.

Diseases and Pests.—See list attached to cabbage (page 47).

LEEK.

The leek very much resembles the onion in its requirements of the soil and cultivation. It is largely used in flavouring soups, &c., the stem being the edible portion. The seed may be sown in seed-beds or boxes in spring, and the plants transplanted to the field when about the thickness of a pencil. The seed may also be sown directly in the field, and the plants afterwards thinned to a distance of about 1 foot apart. The plant requires liberal manuring as it is a gross feeder.

In order to blanch the stem the plants are either set in trenches which are afterwards filled in, or planted on the level and the soil hilled to the stem. Leeks are usually marketed in bunches. "London Flag" is the best known variety.

Diseases and Pests.—See list attached to onion (page 67).

LETTUCE.

This crop, which is used extensively in the making of salads in summer time, grows best on a sandy loam with a high humus content. To procure good heads rapid growth is necessary, and the crop being a shallow rooter should not be grown unless there is an abundance of water available. The soil should be formed into narrow beds about 4 feet wide and raised to allow for drainage.

Seed should be sown in spring and autumn. Late spring sowings are not advisable where the plants are transplanted, as the tendency is to run to seed during the hot months. At that time of the year it is preferable to sow the seed in rows where the plants are to remain, and to thin out to the proper distance. Autumn sowings may extend well into the winter months in favoured localities.

The plants should be set out at a distance of 8 inches to 1 foot apart each way, according to the variety.

The previous application of well rotted manure to the soil and the later application of liquid manure will be found beneficial and promote rapid development of the heads.

There are many varieties of lettuce, and the following are recommended for their particular qualifications :—

Mignonette and May King.—Small early varieties suitable for household gardens.

Wayahead, Wonderful or New York, Deacon, Neapolitan, Salamander, and Drumhead are all good varieties, and the best for summer growth.

Big Boston is the best in cooler months.

White Cos and Green Cos—The Cos varieties are upright growers, and do not form hearts. It is usual to tie the tops in order to blanch the inner leaves.

Diseases and Pests.—This vegetable is chiefly attacked by the same troubles as cabbage (see list on page 47).

MARJORAM.

See Herbs (page 56).

MARROW.

See Pumpkin (page 73).

MELON.

Like all plants of the cucurbitaceous family, melons are susceptible to frost, and require rich, warm, and thoroughly well-drained soil.

Soil and situations favourable to the production of maize will suit melons admirably. They also do pretty well on sandstone ridges, but their culture in such places should be limited to domestic purposes. Where melons are grown for market they should be planted in the open, where they can at all times during the earlier stages of growth, receive cultural treatment in the way of checking of weeds and conservation of moisture.

Owing to the ease with which all plants of this family are cross-fertilised at the flowering stage by the agency of bees and other insects, it is difficult to maintain purity if more than one variety is grown.

Water-melons.—For market purposes melons of fair size, with firm flesh and good keeping qualities are preferred. The best-known varieties possessing hese qualifications are Tom Watson, Cuban Queen, Ice Cream, Kolb's Gem, and Kleckley Sweets.

Rock Melons.—Many of the most delicately-fleshed rock melons are bad carriers. Elongated, delicate varieties are not as profitable for market purposes as the globular-shaped, firm-fleshed types, of which the most popular are Rocky Ford (or Netted Gem), Hackensack Early, Fordhook, and Spicy Cantaloupe.

Preserving Melons.—There are a number of varieties of preserving or pie melons which are in considerable demand for jam-making, and also for juicy stand-by fodder, Citron being a well-known and generally approved variety. Large overgrown specimens are not as suitable as the medium sized for jam making.

Cultivation of the Water-melon.

It is important in connection with melon culture that planting should be early, more especially where melons are being grown for commercial purposes, so that the fruit shall be available at the season when it is most desirable—the height of summer.

Various devices are adopted for germinating the seeds early and ensuring that the young plants shall suffer no check when being set out. Some successful growers collect old jam and other tins, and after melting off the tops and bottoms, arrange them, filled with fine mould, in shallow boxes or trays. A couple of melon seeds are sown in each tin very early in the season, and the boxes are placed in some warm and sheltered place. By the time the season is sufficiently advanced to permit of safe planting in the open the plants are a fair size, and can be readily set out. With a little care the tins can be slipped off without interfering with the roots.

A variation of this system is in use in parts of the United States, where the seed is sown in what are descriptively called "dirt bands." Thin strips of wood veneer, 3 inches wide and 18 inches long, are scored at intervals of 4 inches, so that they can be bent without breaking, and are folded into

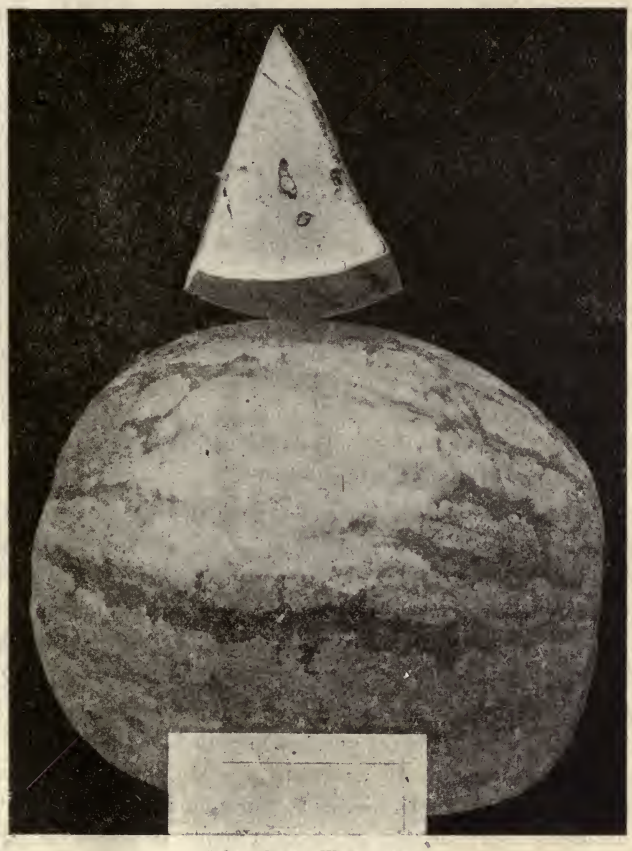
squares so as to resemble a small strawberry punnet without the bottom. These squares are placed close together in a hot-bed, and filled level with fine rich soil. With a block of wood shaped for the purpose the soil within the squares or bands is pressed until it is $\frac{1}{2}$ to $\frac{3}{4}$ inch below the top. If only part of the soil is put in first and pressed down firmly, and the balance is then added and similarly treated, a more compact square of soil is obtained, which will hold together better during transplanting. Unless the soil was very moist in the first instance the bed is then thoroughly wetted. Next, three seeds are placed in each square, and covered with enough fine, loose soil to bring all level again with the tops of the bands. The last layer is not firmed.

Kolb's Gem Water-melon.

The hot-bed for melon plants should have full exposure to light, and be maintained at a high temperature—about 85° Fah. during the day, and 60° to 70° at night. As much ventilation should be given as the weather will permit, and care exercised to avoid over-watering.

As soon as the plants are started they are thinned to two in each square by cutting off the weakest with a sharp knife. When they are about 4 weeks old from planting they are deemed large enough to transplant to the

field. The bed is thoroughly watered, and the bands, enclosing their masses of earth and plant roots, are lifted by means of a spade placed on a flat surface, and carried to the field, where they are set out with the aid of a flat trowel, care being taken that the bottom of each square is in close contact with the soil of the hill. The band is then removed, and fine, moist soil is drawn in and firmed against the little square.



Cuban Queen Water-melon.

For the production of water-melons on a commercial scale a warm climate and an assured supply of moisture are essential; for market purposes, therefore, the crop is practically limited to the coast or to areas in the west that can be irrigated.

Melons respond to a liberal supply of farmyard manure, worked in and about the hills. Where this is unobtainable a mixture of artificial manure containing superphosphate, bone-dust, and blood, in equal parts, and applied at the rate of 2 to 4 cwt. per acre, is useful.

In field culture the usual practice is to strike out furrows with the plough, say 10 feet to 15 feet apart, according to the soil conditions. Hills are worked up in the furrows 6 to 8 feet apart with ordinary or pronged hoes, and the seed placed under the surface, or the plants set after having been raised as described above. If seed is planted out at once, plenty should be used to allow for losses. Some farmers throw a few handfuls of dry farmyard manure on the top of the hill, so that the soil will not cake.

The land is cultivated between the rows as long as the vines will permit, after which they are left to themselves.

Melons are usually marketed in open trucks, without either bags or crates. Large numbers of melons, grown on the banks of North Coast rivers are marketed without any packing, the growers simply taking the precaution of scratching a brand on the rind.

In the case of home-grown crops greater care is taken in preparing the hills, more manure being used, and the plants being specially treated with liquid manure.

Diseases and Pests.—See list attached to pumpkin (page 74).

Rock-melon Culture.

A good stiff loam that responds well to cultivation has been found to be the best soil for this crop. It should be broken up about June, left until early Spring, and then brought into condition.

A method of raising early crops that has been successfully adopted by some growers is as follows:—Holes are dug about 6 feet apart in drills which are about 9 feet apart, and a quantity of poultry manure, which has been thoroughly decomposed in a pit or trench during the previous year, is thrown into them. This manure brings the soil in the holes into a very favourable condition for growing the melons, and the seed is then planted into it.

As early crops are desired the seed is shot before sowing. This is done by soaking it for twenty-four hours and placing it in a bag, which is again placed in a bag of chopped up green-stuff. The heat generated by the fermenting green-stuff causes the seeds to send out its shoots rapidly, and as these are naturally very brittle great care must be taken of them when planting.

Rock-melons may also be grown by the same methods as water-melons, and the same devices used for transplanting.

Cultivation between the rows should be carried out systematically, and for as long as it is possible without damage to the plants, which are delicate, and easy of injury.

Diseases and Pests.—See list attached to pumpkin (page 74).

MINT.

See Herbs (page 56).

MUSHROOM.

For the successful culture of mushrooms it is essential that the crop be grown either in very rich "made" soil or in a prepared manure bed, and in a temperature that does not exceed 86 degrees Fah., and does not fall below 50 degrees Fah. This second condition is obtained by making use of cellars, disused tunnels, old houses, &c.

Having obtained a suitable place, the bed must be prepared. Its chief constituent should be good horse manure that is fairly free from long straw, but several mixtures may be employed—(*a*) a mixture of earth and manure, (*b*) horse manure with no earth, (*c*) cow manure and horse manure are also sometimes used, being mixed in equal quantities.

Where earth and manure are used, it is quite usual to mix a fourth or fifth part of good soil with manure fresh from the stable. The process of fermentation is then slower, and the heat more constant.

When manure only is used, the bed must be properly prepared, as stable manure ferments quickly, and produces a degree of heat that is unsuitable for the purpose. The method usually employed is to mix the manure thoroughly, so as to make it of even character throughout, place it in square heaps about 3 feet high, and then beat or tread it down well. If it is a little dry it should be moistened somewhat, and then left to ferment until the heat has increased to such an extent that portions of the manure in the centre begin to turn white, which usually occurs in about a week. It is then necessary to break the heaps up and remake them as before, care being taken to place the material that has been on the outside of the heap at first in the centre when it is remade. Within a few days fermentation will have again increased so much that it will be necessary to remake the heaps a second time. After this treatment the manure will become a brown colour, and somewhat greasy. It will be found that, in order to obtain the necessary consistency, the heaps must not be of less size than a cubic yard.

When in the required condition, the manure should be made into beds about 2 feet high and 2 feet wide, and should have a flat surface, or, if made against a wall they may slope from the wall to the floor. Beds are sometimes made in old tubs or half-casks. In any case they should be firmed, and allowed to remain a few days in that condition before spawning.

The correct time for spawning is when the temperature is about 78 degrees Fah., and it is important that this should be determined with some accuracy. A thermometer should be used, a pointed dairy thermometer being useful for this purpose.

The spawn is sold in brick form by leading seedmen. For some days before spawning these bricks should be kept in a moderately warm, moist place, so as to stimulate the mycelium of the fungus. Sometimes they are moistened

on each side and spread out between a couple of beds. Before use, the brick should be broken up into pieces about 6 or 7 inches long, 2 inches wide, and 1 inch thick. Each piece is then inserted lengthwise in the bed and flush with the surface, in openings that have been made with the hands at distances of about a foot apart each way. Usually in beds 20 to 24 inches wide there are two rows, the pieces in one row being opposite the spaces in the other. The manure must be carefully heaped over and pressed round each piece, so that it is covered to a depth of about 1 inch.

If the conditions are satisfactory, the spawn should commence to grow in about seven or eight days. At the end of that time, any pieces that have not commenced to produce white threads connecting with the surrounding manure should be replaced by fresh ones. In a fortnight or three weeks after spawning, the spawn should have spread throughout the bed, and should begin to show itself at the surface. At this stage the pieces of spawn should be withdrawn, or they will become mouldy and soil the mushrooms in their immediate vicinity. The empty openings should be carefully closed by pressing down the surrounding soil or manure. The top and sides of the bed should then be covered with a layer of about half an inch of light loamy soil which is in a fairly moist condition, and lightly pressed down. When the surface becomes dry, light waterings should be given.

It may be explained that the white threads are the foraging portions of the fungus, but it does not usually produce mushrooms until it comes into contact with some medium less favourable for its growth than the manure; hence the covering of soil.

Within a few weeks of the last operation the mushrooms should appear, and should continue to yield for two or three months. The watering of the bed is usually done with liquid manure, or water containing some nitrogenous fertiliser, such as nitrate of soda, and the temperature of the liquid should be between 70 and 80 degrees Fah. Do not water the beds too freely; damage is often done this way.

Beds made in open places that are exposed to changes of temperature need to be covered with straw.

MUSTARD.

This crop grows at an exceedingly fast rate, and although usually grown as a field crop for its seed or as a green manure, it is also used in the early stages of growth as a salad crop, or later, the top growth may be boiled as are other greens. Very little is grown in this State for vegetable purposes.

The crop is usually grown in conjunction with cress (see page 54). As only small quantities are required at a time, it is better to make continuous sowings at regular intervals. Seed-boxes can be successfully utilised for growing this crop.

Seed should be sown in shallow drills, and every attention given to an ample supply of moisture. The variety usually grown is known as White, and its leaves are pulled as soon as they are large enough.

NEW ZEALAND SPINACH.

This plant is not botanically related to the common spinach, but it can be planted in the spring to provide greens for use throughout the summer when the other vegetable cannot be grown. The plant is hardy, and given a good soil and water supply will make quick growth. It should be allowed to attain a fair size before cutting off any of the end growths, which are the edible portions. With this treatment numerous new shoots will be sent out and a constant supply kept up throughout the summer. The plants will grow to a fair size, and should be planted not less than 2 ft. 6 in. by 1 ft. 6 in. apart. If not kept within bounds it is likely to become a weed.

ONION.

A large quantity of onions is annually imported from other States for sale in our markets. Local production could be considerably increased ; the plant is easily grown, providing the soil is of fair quality and good methods of cultivation are adopted. The chief point to be observed is that the ground

Onion Seed-bed.
Plants ready for transplanting.

must be kept free from weed growth; once weed seed has been worked out of the ground, little trouble will be experienced, as fresh infection may be easily checked. Onions can be grown on the same ground year after year, as the crop does not exhaust the soil as most vegetables do, and is particularly free from disease. Where artificial manures are required, a mixture of equal parts of superphosphate and bonedust at the rate of 2 cwt. per acre will be found useful.

The most suitable soils are well-drained, fertile loams, the heavier class of soil generally producing good-keeping bulbs which take a little longer to mature than those grown on lighter loams. On sandy soils, a quick-maturing, thinner-skinned bulb is produced, which does not as a rule keep so well.

As a field crop, onions should not be grown in larger areas than can be properly tended, owing to the large amount of hand-labour that is required.

The ground should be well worked and in good condition for this crop. The seed can either be sown in seed-beds and the plants transplanted to a distance of 4 to 6 inches apart in rows with 15 to 18 inches between them, cutting and pinching back the tops and roots when doing so, or else may be sown in drills direct in the field, and the plants afterwards thinned. Seed should not be sown deeper than one inch.

In all cases it is important that the seed should be firmed in, otherwise germination may be very slow and irregular.

In the warmer districts seed may be sown from March to August; the plants from later seedings do not form up well in the warm months. On the tablelands the main crop is best sown in April and May. From 2 to 3 lb. of seed is sufficient to plant an acre, and as onion seed quickly loses its vitality it is important that only fresh seed be sown. All cultivation should be shallow owing to the roots being close to the surface.

Harvesting.

Onions take from six to seven months to completely develop. Bending the stems over is a great aid to ripening. When the tops are withered and are dry and crisp, the bulbs should be lifted; the plants are simply pulled by the hand, three or four rows forming one windrow. They should be allowed to remain in the sun for about five to seven days, the length of time depending on the weather, but they should not be allowed to scald. If the weather is wet it may be desirable to take the bulbs under cover, spreading them out in an open dry shed and turning them occasionally. Some growers adopt the method of bunching and suspending them. Before bagging, the tops and roots should be trimmed off, leaving about an inch of the top on the bulb; sheep shears are very suitable for the purpose. Great care should be taken not to bruise any of the bulbs, for decay sets in quickly. Storage is best effected in cases, in a well-ventilated shed. Under fair conditions a yield of 4 to 6 tons per acre can be expected.

Varieties.

Those recommended are Hunter River Brown Spanish, Brown Globe, Yellow Globe, Market Model, Danver's Ailsa Craig, and Silver Skin. The small bulbs of the last variety are largely used for pickling.

Diseases and Pests.

Cutworm (page 114); eelworm (page 118); onion blight or downy mildew (page 99); onion maggot (page 120).

PARSLEY.

See Herbs (page 56).

PARSNIP.

As the parsnip is a deep-rooting plant it is obvious that a deep soil is the most suitable. Even where the soil is of a shallow nature, the crop can be grown successfully, provided that the land be deeply worked. A sandy loam, if not too light in character, is the best class of soil, but fair results can be obtained in almost all soils with proper methods of cultivation.

Manuring of the surface soil with organic fertilisers immediately previous to planting is apt, as is also the case with carrots, to cause branching and distortion of the roots, thereby making them unsaleable. Hence, a good plan is to work parsnips into a rotation so as to follow a heavily manured crop, such as cabbages. When planted in the spring, the parsnips are ready for use in early autumn, but, if so desired, can be left in the ground throughout the winter. It is usually considered that a frost before harvesting improves the quality of the vegetable.

Sowing during the hot months of the year is not likely to succeed to the same extent as the spring sowing, as, in the latter case, the young plants have a chance of becoming firmly established before the hot weather sets in.

Owing to its poor germinating qualities the seed should be sown very thickly. It is planted in rows 15 to 18 inches apart, covered to a depth of about 1 inch, and then well firmed in the soil. The thinning of the crop, when necessary, is different to that of carrots, and should be carried out in the one operation as soon as the young plants are of sufficient size. A distance of 3 or 4 inches should be left between the plants. The tops will quickly make a strong growth, and the only attention required will be the keeping down of weeds and a thorough cultivation between the rows during the early stages of growth.

On deep soils this crop lends itself to field practice, and under these conditions from 6 to 8 lb. of seed per acre will be sufficient to obtain the best return. The seed must be fresh.

The crop is harvested as required, and if the land is needed for other crops storing in pits in a cool situation will be found quite satisfactory. For lifting, it will usually be found necessary to loosen the ground with a fork. For marketing, the roots should be washed, and may be bunched or forwarded loose in bags. It is always advisable to grade the produce.

The most popular variety is Hollow Crown, but Student is also largely grown.

Diseases and Pests.

Cutworm (page 114); eelworm (page 118); white rust (page 109).

PEAS.

The popular garden pea can be grown in almost any part of New South Wales, though allowances must necessarily be made for climatic and other conditions in considering the proper time to plant.

The pea plant itself is not subject to frost; though an inopportune "freeze" at flowering time will destroy the pollen, and therefore the capacity of the plant to set its pods, and will even damage the pods while in their tenderest stages. Young pods that have been frosted, and that are unlikely to develop, may be distinguished by a characteristic white mottled appearance on the outside skin. The pea is naturally a cool-climate plant, and little success can be expected from it in the height of summer, except in cool elevated districts.

A sandy loam is most suitable for the crop, but almost any soil of fair average quality will yield good results. As with all legumes, the supply of nitrogen in the soil is a matter of less moment than that of phosphoric acid, potash and lime, and hence it is that in some localities dressings of fertilisers that contain the last three have a material effect upon the yield. The crop has the strong recommendation that in addition to yielding profitably, it contributes to the fertility of the soil for the purpose of subsequent crops by increasing the store of nitrogen, and by enabling the gardener or farmer to add to it a considerable quantity of top-growth of a kind than humifies readily when turned under. It does well on newly-broken land, and can be used as a preparation crop; indeed, there are some farmers who own a decided preference for it as a first crop in their own district.

In coastal districts, planting may be made as early as March in frost-free situations, and continue till October, when the crop for the Christmas market may be sown.

On the tablelands, plantings are made from September to a time—usually December—likely to catch the Easter market.

Sowing, Cultivating and Harvesting.

The water requirements of a crop of peas are considerable, and the preparation of the soil should be commenced early enough to enable a supply of moisture to be stored. The land should be cultivated as required to conserve all rain that falls, to destroy weeds, and to produce a good tilth in which the roots will find favourable conditions.

Both the maize drill and the wheat drill can be used for planting the seed, but in the latter case sufficient of the feeders must be closed up to obtain the proper distances between the rows. It is much the more common practice, however, to open up shallow drills, drop the seed by hand, and cover to a depth of about 2 inches by means of a harrow, light cultivator, or hand hoe.

Where hand sowing is carried out the sowing box will be found useful (see illustration, page 17). It is a good plan to plant two rows at a distance of 6 to 9 inches apart, and to leave a space of 2 ft. 6 in. to 2 ft. 9 in. between each pairs of rows. The seed should be planted 2 to 3 inches apart. This system of planting assists the plants in maintaining themselves in the soil and is productive of heavy yields. About one bushel of seed will sow an acre.

The most suitable artificial manure for peas is a mixture of equal parts of superphosphate and bonedust applied at from 1 to 2 cwt. per acre.

In picking, the pods should be gathered immediately they fill; if left on, they prevent to an extent the proper setting of immature pods. Peas are generally marketed in bags of a convenient size.

Varieties.

The dwarf varieties are chiefly grown for market, and are quicker in maturing than the tall-growing kinds; the latter are generally bigger-podded, and require staking. Those recommended are William Hurst and Hundredfold for early crops; and for the main crop, Richard Seddon, Nottingham Defiance, Yorkshire Hero, American Wonder, Stratagem, Daisy, and Duke of Albany.

Yorkshire Hero is the standard main crop variety. Other varieties, such as American Wonder, Richard Seddon, and Nottingham Defiance should be largely grown for market as they have proved very suitable. Duke of Albany is about the best of the tall-growing sorts.

Diseases and Pests.

Cutworm (page 114); eelworm (page 118); mildews (page 103); rust (page 107); weevil (page 126).

POP CORN.*

Pop Corn is a home delicacy which is greatly enjoyed by children. The cultivation, manuring, preparation of the soil, and planting, are similar to that given for sweet corn (see page 77).

The pop corn plot should be sown at least three weeks before or after any other corn, such as sweet corn, as intercrossing easily takes place if flowering occurs at the same time, to the detriment of both crops.

The corn should be allowed to mature thoroughly on the stalk and should then be allowed to dry thoroughly before shelling. At least a couple of months should elapse after harvest before the corn is fit to pop.

*H. Wenholz, B.Sc. (Agr.), Inspector of Agriculture.

For popping in the home an ordinary frying pan is used and it should be shaken from side to side over a brisk fire with the corn just covering the bottom of the pan. It is preferable to have a lid on the pan.

After popping a sprinkling of salt and a coating of butter, chocolate, or syrup, will improve the flavour considerably.

The varieties recommended for the home garden are Black Beauty, Queen's Golden, Mapledale Prolific or White Pearl, and White Rice.

POTATO.

Of her annual consumption of potatoes New South Wales produces only approximately one-half. An ample market, then, awaits the local grower at his very doorstep, and with rising freights our growers should more easily compete with the produce of other States. It will be essential, however, for him to supply graded produce.

Potatoes can be grown successfully on many soils. Sandy loams, loams, or friable clay loams are most suitable. Light sands and heavy clays are unsuitable, but not impossible. Sandy soils are earlier than clay ones. Small areas worked properly will give better quality potatoes and higher returns than large ones farmed "anyhow." It is true that good crops are often obtained even when planted under the sod; it is also true that the same methods on cropped lands will spell failure.

The supply of humus or organic matter in the soil must be maintained, and in some cases increased, to obtain proper soil texture and water-holding capacity, both so important in producing maximum crops. Organic matter is applied either as a green manure or in the form of farmyard manure; but as the latter encourages "scab," its application is advisable some time before planting. Continuous cropping with potatoes is ruinous; rotation means better crops and less disease. Deep working of the ground—say, 8 inches—in autumn is recommended, and early spring cultivation is necessary to conserve moisture and bring the soil to the proper tilth.

The result of this preparation is that the soil is in such good condition when sowing time arrives, that it is unnecessary to wait for rain before planting the seed. The grower is thus able to start with the knowledge that he is sowing at the right time, and that he can sow the whole area at once. It is well known that cut seed cannot be sown in a dry seed bed because the seed dries out, and poor germination and a patchy crop result. If, however, preparations have been made in the way advised, there is usually ample moisture in the soil.

Selection and Treatment of Seed.

Quality of seed is important. Select the best—continual selection will increase the yield. "Pig" potatoes or culls should on no account be used for seed.

The treatment of seed is also important; variety and treatment often assert a greater influence on the yield than cultivation and manuring. Seed exposed to light and air is better than that taken direct from the pit. Where early crops are grown, more especially on the coast, the question of "boxing" the seen in autumn should receive consideration. This treatment causes a greening of the tubers, and develops short, sturdy, green shoots which are not easily broken off. In addition to this, the crop gets an early start, and there is less loss in storage.

On coastal areas seed from cooler districts should be obtained at least once a year. Immature seed is considered better than mature, and to this fact is attributed some of the superiority of cold-country seed. If a seed is cut, the sets should be as uniform as possible; the number of eyes in the set has not the same influence on the production as the size of the set. The sets are dropped 12 to 18 inches apart in drills 27 to 30 inches apart, and afterwards covered 4 inches deep. The manure should be dusted along the furrows in which the sets are planted.

Manurial Recommendations.

The following, based on financial results from farmers' experimental plots, are manurial recommendations for various districts :—

District.	Manure recommended per acre.	Approximate cost per acre.
North Coast	2 cwt. superphosphate or 1½ cwt. superphosphate and 1½ cwt. bonedust	12/- 22/-
North Coast Plateau..	1½ cwt. superphosphate and 1½ cwt. bonedust	22/-
South Coast	2 cwt. superphosphate and ½ cwt. sulphate of potash	27/-
Northern Tablelands..	2 cwt. superphosphate and ½ cwt. sulphate of potash on sandy soils 2 cwt. superphosphate on clay soils	27/- 12/-
Central Tablelands ..	1½ cwt. superphosphate and 1½ cwt. bonedust	22/-
Southern Tablelands..	1 cwt. superphosphate, 1 cwt. bonedust, and ½ cwt. sulphate of potash	30/-

Time of Planting.

The time of planting varies with the district. On the coast two crops are grown, the first being sown from June in the far north, to September in the south. This crop usually realises high prices, because it generally comes on a bare market. The second crop is usually planted in February and harvested during the winter, when potatoes are cheaper. Seed for this crop is obtained from the spring crop.

On the tablelands the main crop is planted during October and November. A few growers plant in September for early use, but the risk from frost is great.

The amount of seed required to plant an acre is approximately 10 cwt.—more or less according to size.

Hilling.

Towards flowering time the rows should be slightly hilled to protect the tubers from sun-scald, frosts, and potato moth.

New tubers always develop over the older ones, and as they become large they will push out of the soil until perhaps half out of the ground if no hilling is done.

At the same time the hilling should not be excessive, as it increases the tendency of the soil to dry out, and also is apt to damage the roots between the rows.

Hilling is a preventive of rot during outbreaks of Irish Blight, inasmuch as the increased thickness of soil over the tubers to a large extent prevents the washing of the spores from the foliage on to the tubers.

Varieties.

There are many varieties of potatoes, but a selection may be made from the list hereunder, which should satisfy any condition or market:—

Coastal Districts.—Early Manistee, Satisfaction, Manhattan, Up-to-Date, Carman No. 1, Factor, Brownell's Beauty.

Tableland Districts—Satisfaction, Early Manistee, Manhattan, Carman No. 1, Brownell's Beauty, Up-to-Date, Factor, Queen of the Valley Surprise, Coronation, Magnum Bonum. The last four can only be grown for the main crop, as they are very late in maturity.

Lifting and Storing.

For the harvesting of the crop, machines have only proved satisfactory on free-working, sandy soils. Digging is mostly done by hand, at a contract rate of about 1s. 6d. per bag, according to crop.

The early coastal crop is lifted as soon as the tubers are large enough and firm enough to carry; at this time the haulms are green, but the lower leaves are yellowing off. Main crops are dug for storage when the haulms have died off, and the sooner they can be dug after reaching that stage the better. If left until midwinter, the weather is disagreeable and much time is lost, while digging is heavier and the tubers do not clean.

Table potatoes are usually stored through the winter in pits. The condition of the potatoes at pitting time is important. They should be as dry as possible, and if the weather permits it is advisable to eave the pits covered with straw only until sweating has subsided, when earthing-up may be completed and drainage provided.

Diseases and Pests.

Dry rot (page 100); early blight (page 101); eelworm (page 118); Irish blight (page 101); potato moth (page 120); scab (page 107); wire-worm (page 127).

POTATO ONION.

This is a class of onion that multiplies by forming a cluster of bulbs or "cloves" around the original set. It is easily grown, and its cultivation does not require the raising of plants from seed. On account of its mild flavour, it is sometimes preferred to the common onion. Sets or cloves are planted in autumn, and may be used as green onions in early summer, or allowed to mature, which usually takes about six months.

Diseases and Pests.—See list attached to onion (page 67).

PUMPKIN.

Seeds of the pumpkin family require a soil temperature of about 80 degrees Fah. for a successful germination. Sowing should therefore not take place until the late spring. The soils most suitable are those containing a good supply of vegetable matter. They should not, however, be too rich, as this tends to produce a great growth of vine, and few fruits.

Should artificial manures be used, a mixture of equal parts of superphosphate and bonedust is advised. Artificial or farmyard manure should be well distributed for some distance round the hills, as the plants send out their roots many feet away from the main stem in search of plant-food.

About 2 lb. of seed is required to plant an acre, except in the case of some of the varieties of squash which have small seed. Two-year-old seed will often be found to produce better results than new seed, which has a tendency to produce plants inclined to run too much to vine.

The seed should be sown in hills 8 feet apart each way for running varieties; for bush varieties of marrows and squash, about 6 feet each way will suffice. About six to eight seeds should be planted in each hill and later thinned to two or three strong plants. Weed-growth should be kept in check until the plants cover the ground.

In order to secure a good setting of fruit early in the season, when, as is often the case, bees are not numerous, it is advisable to hand-pollinise the female flowers so that fruit may be set. This is done by taking a flower containing the pistil and dusting ripe pollen from it on to the organs of the female flower shortly after the blossom opens. When the crop is setting it is advisable to pinch back the runners, to throw the strength of the plant into the production of fruits. Some of the varieties of squash are very early and mature in a couple of months; others take five or six months.

Storage.

The keeping quality depends largely on the degree of ripeness. It will be found that if left until it is difficult to pierce the rind with the thumbnail they will keep throughout the winter, providing they have been harvested with the short stalk attached. Pumpkins from early-sown crops keep better

than those from late crops, as they have longer to ripen off. Care should be exercised that the fruit is not bruised in handling. They should be stored on slatted shelves in a dry, airy shed, and looked over from time to time, any showing signs of decay being removed.

Varieties.

The following are the recommended varities of the various plants in the pumpkin family :—

Pumpkins.	*Squashes.*	*Marrows.*	*Rios.*
Crown.	Summer Crookneck.	Mammoth White Bush.	Trombone.
Button.	White Bush or Patty Pan.	Cocozelle.	Mammoth
Ironbark.	Fordhook.	Long White Marrow.	
Triangular, Pansy, or Shamrock.	Hubbard.		
Sugar or Pie.	Golden Hubbard.		

Diseases and Pests.

Downy mildew (page 99) ; eelworm (page 118) ; powdery mildew (page 104) ; pumpkin beetle (page 111) ; spotted ladybird (page 124).

RADISH.

This is a quick-growing vegetable that under our congenial climatic conditions can be grown practically throughout the whole year.

In the elevated portions of the State, the crop will not succeed in mid-winter unless given some bottom heat in the shape of fresh manure ; but at least 6 to 9 inches of soil should be placed on the manure, and it may even be necessary to put some cloth covering over the beds during the cold night Raising the plants in such localities during cold weather is better carried out in the hot frame. In the heat of summer in the coastal and western districts it is advisable to provide shade. The crop is one that can be profitably grown in conjunction with other crops, such as parsnips, &c., with which germination is slow ; the radish attains sufficient size for use before the parsnip plants are large enough to be harmed. This practice has the additional advantage of indicating where the parsnip seed has been sown, and thereby allowing of an early cultivation between the rows before the main crop actually appears.

Where the crop is cultivated in beds, the sowings should be small and frequent, in preference to several large plantings. The seed may be sown either in rows or broadcast, the rows varying from 6 to 15 inches apart, but in all cases the seed should be sown thinly and not covered more than half an inch deep. It is usual to firm the surface soil after planting, and a mulching of fine dry horse manure will be found beneficial.

A sandy soil is the best suited for the growth of the radish, but heavier soils can be brought into a suitable condition. As with other root crops, the incorporation of stable manure in the soil just previous to planting is not

advisable; it is likely to cause forking of the root. This is overcome by planting after such crops as celery, cabbage, &c., which have previously received liberal applications of manure.

Moisture and warmth are essential, and on heavy soils the beds should be raised to ensure proper drainage.

Unless the crop is grown quickly, the roots will become pithy and hot, and in order to ensure even growth the young seedlings should be thinned out. Many people never bother to thin radish, allowing the crop to grow as it germinates, considering the pulling out of roots when big enough for use as sufficient thinning. By this method some roots occupy the ground for a long time, and become of inferior quality.

Radishes are of several shapes and may be classified as "turnip," "olive" or "intermediate" and "long." Of the turnip-shaped varieties, the following may be recommended: French Breakfast, Red, White. These varieties are not as largely grown in this State as the longer sorts.

Of the olive-shaped or intermediate class, Rose is a good variety. Of the long varieties, Long Scarlet may be mentioned as long and slender, smooth-skinned, good colour, and having a very transparent flesh, tinged with pink. It grows from 5 to 6 inches in length. Another long variety, used only for autumn sowing is White Chinese, a very large cylindrical-shaped radish of mild flavour.

Diseases and Pests.—In general this vegetable is subject to the same attacks as the turnip; for list, see page 90.

RHUBARB.

Rhubarb is a perennial plant producing thick, acidy stems of commercial value. It requires rich soil or heavy manuring with organic matter, such as stable manure. It is essential that the root crowns be fully formed before large pullings of the leaves are made. Many people make the mistake of drawing on the plant almost as soon as any large leaves have formed. As with asparagus, this treatment does not allow of the development of the plant, and consequently large yields cannot be expected for any length of time.

For planting out, the roots of older plants may be divided and set—care being taken that each root-piece contains a bud or crown—or one-year-old roots may be used. These can be purchased from any seed merchant, or the plants may be raised from seed. The latter method takes a year longer in establishing the plantation, but it is the cheaper of the two. If this method is adopted, the seed should be sown in the spring in prepared seed-beds.

The plants should be set out 4 feet apart each way, or even more. Unless the soil is naturally rich, such as is found on alluvial flats adjoining a river, the places in the field where the plants are to be set should have been

fertilised with well-rotted stable manure prior to planting. Where artificial manures are used, those containing a percentage of nitrogen are advised, such as blood and bonedust, at the rate of 3 to 4 cwt. per acre.

The first year's cultivation in the field should aim at keeping down weed growth and stirring the soil; pulling of stems this season is not advisable. During the following autumn or winter each plant should be given a dressing of farmyard manure, which should be dug in later on. Each succeeding autumn the crop should be well manured and the soil kept loose between the plants throughout their growth.

When the crop is in bearing only the larger leaves should be pulled, and these, by holding the leaf stem well down towards the crown and making a straight pull, or else making a jerk downwards, while at the same time giving the stalk an outward twist. The leaves should be tied in bunches of suitable size for marketing, and the stems in the bunches should be of one grade. The smaller leaves are allowed to grow, in order to recoup the plant for some of the loss occassioned by the pulling of the larger leaves. Should the plants attempt to run to seed, the seed heads should be immediately cut out as seed-bearing is very exhausting. If it is desired that the bed should last for any length of time, pulling must only be carried out during a few months of the year, and not too many stalks should be pulled from the plant at the one time.

In order to obtain extra long stems it is usual to place half barrels or boxes, without tops or bottoms, over the plants, and thus by partially excluding the light, to cause elongation of the stems.

Of the several varieties on the market the following may be mentioned as among the best:—Sydney Crimson Winter, Victoria or Giant, and Topps' Winter.

ROCK-MELON.

See Melon (page 59).

SAGE.

See Herbs (page 56).

SHALLOT.

See Eschalot (page 55).

SILVER BEET OR SILVER SPINACH.

See Beet (page 42).

SPINACH.

A plant grown for its leaves, which are boiled and served like cabbage. It is best suited for cool districts, and in the warm districts of the State it should only be grown in the cool weather. On the tablelands, plantings are made in the spring and autumn. When the plants are up they must be kept well watered during dry times else they will run to seed.

The seed can be sown directly in the field, in rows 12 to 15 inches apart, and afterwards thinned, or may be transplanted.

For home use plants may be cut when of sufficient size for boiling, but for marketing should have formed a fair sized rosette of leaves. The harvesting is easily done by cutting through the stems of the plant under the leaves. On account of top growth being required, the crop is one which requires very fertile soil.

Giant Viroflay is the largest growing variety, being very suitable for the cool districts. Victoria Dark Green is a suitable variety for the warmer districts, not running to seed as quickly as a number of other sorts. New Zealand Spinach is quite a different plant; for suggestions as to its culture, see page .

Diseases and Pests.—See list attached to cabbage (page 47).

SQUASH.

See Pumpkin (page 73).

SWEET CORN OR TABLE MAIZE.*

The demand for sweet corn as a vegetable is slowly but surely gaining ground in New South Wales; in America it is practically impossible to find a home garden without it.

Sometimes white varieties of dent maize are used in the milk stage for "roasters" or boiling as sweet corn, but these are by no means to be compared with the true sweet corn varieties for flavour.

Sweet corn is a warm weather crop, and the site chosen should be one which gets a large share of sunlight, such as a northerly or easterly slope.

Well rotted stable manure supplemented with superphosphate at the rate of about 1½ or 2 lb. per cwt. of manure will be found to be about the best for sweet corn. The growth is somewhat slow at first, and superphosphate applied in the drills before sowing the corn has the effect of encouraging a vigorous, early root growth and giving the young plants a good start. The ground should be well prepared before winter if possible, and the stable manure should be applied during the operations and well mixed deeply with the soil.

The rows should be made about 3 feet apart and 6 or 8 grains sown together every 3 feet in the rows. When the plants are 8 or 10 inches high, the number of plants should be thinned down to three or four, advantage being taken to remove the weakest seedlings in the hills, and leave only the most vigorous.

Planting may take place in the Sydney district from the middle of September to early in January.

* H. Wenholz, B.Sc. (Agr.), Inspector of Agriculture.

Cultivation between the rows should be shallow and frequent, the depth not exceeding 3 inches and the frequency at least once a week for best results. The removal of the suckers during growth is not advised.

The harvesting stage is usually denoted by the colour of the silks turning from brown to black. At this stage the grains will be in full milk or just turning to soft dough. The cobs soon lose their flavour after harvesting, and should therefore be utilised at once. Roasted and eaten with sauce or butter or boiled, especially with corned meat they are delicious.

As a rule, the very early varieties of sweet corn are rather poor yielders with small cobs. The best varieties for the home garden are Mammoth White Cory, Crosby's Early, Cosmopolitan, Ruby, White Evergreen, Country Gentleman, Stowell's Evergreen and Papago.

Diseases and Pests.—Cutworm (page 114).

SWEET POTATO.

Sweet potatoes are not cultivated in this State to the extent they deserve. They have been successfully grown at Queanbeyan, Howlong, and in a few isolated places in the dry west where water is available, and generally speaking may be expected to do better in the warmer districts on the coast and inland than on the cool tablelands. If a little attention be devoted to keeping down weeds and conserving moisture by hoeing it is surprising how much dry weather the sweet potato will stand.

The ideal soil for this crop is a sandy one which has been well supplied with organic matter. In a soil of this character, the plants possess almost all the hardiness of weeds, and the roots develop well, being even in quality and of good shape. As the crop is a deep rooter, a thorough preparation of the land is necessary.

It is a good plan to plant sweet potatoes after a crop which has been heavily manured with farmyard manure. If artificial fertilisers are used, a mixture of equal parts of superphosphate and bonedust, applied at the rate of 3 cwt. per acre, planted in the drill with the plants, is recommended. In cool districts it is likely that the application of 25 lb. to 50 lb. nitrate of soda to the acre, in addition to the above mixture, will be found beneficial.

Propagation.

The crop is propogated—not by planting tubers in the field—but by means of shoots or "plants" which grow from the tuber. When bedded or planted, sometimes as many as fifty "plants" will grow from a single small tuber (see illustration), and two or three pullings may be obtained in a single season.

The plants necessary for producing an early crop are obtained by placing the roots—usually small, slender tubers kept over for this purpose from the previous season—in sand in a cold frame or hot bed. The tubers should be placed close together, but not touching, and then covered with 2 or 3 inches of sand (river sand preferred); the whole bed should then be well watered and covered with a glass sash or frame of hessian. By raising a corner of the frame, enough air can be admitted to prevent rot setting in. The bed should be kept moist, but not wet, and covered until the plants show through the sand when the covering should be removed during the daytime, but replaced at night. This is done until all danger of frost is past. The "plants," when 6 or 8 inches long, are ready for planting out. (See illustration)

By bedding the roots early, the addition of bottom heat is unnecessary in comparatively warm districts. If tubers are set in the frame about the end of July or beginning of August, plants will be ready as early as it is safe to put them out. Plants raised on sand, and without artificial heat, are hardier

Sweet Potato "root," with plants ready for breaking off and planting out.

than if raised in a rich compost and on a hot bed, and in addition, the risk of introducing disease is lessened. In a cold district, or where bedding-down has been delayed, it will probably be found necessary to use some sort of bottom heat.

One or two tubers, bedded in a small box or kerosene tin, if placed in a sunny situation, and covered at night, will supply sufficient plants for a kitchen garden.

In mild districts, plants quite early enough for a main crop can be obtained by bedding the tubers in the open ground in a sheltered situation with an easterly aspect, or, cuttings 6 or 8 inches long may be made from the vines of the early-planted crop and set out in the same way as the plants

obtained by bedding. These cuttings will grow quite readily, and the crop produced by planting them seems to keep better than the early crop. Small tubers are the best for producing plants; 1 cwt. will produce at one "pulling," 4,000 to 5,000 plants, and will occupy 90 to 100 superficial feet in the cold frames.

Planting Out and Cultivation.

The planting is commenced at any time when all danger of frost is past; it can be continued in the coastal districts right up to the beginning of January with every hope of a good crop.

The shoots or plants should be carefully drawn from the bed and put root downwards in a bucket of water or a mixture of cow-dung and water. For planting they should be drawn from the bucket as required and placed 2 feet apart in rows which are 3 feet apart.

Sweet Potato plants for setting out raised in a Hessian frame bed.

The plants may be ploughed in at the time the ground is getting its second or final ploughing. When this method is adopted, the plants are placed the required distance apart in every third or fourth furrow, the necessary covering being given by the plough as it turns the succeeding furrow.

A common plan is thoroughly to prepare the ground first and then dibble the plants in with a spade. This method is somewhat slower than ploughing in, but for ordinary conditions it has been proved the most satisfactory. A man and a boy can plant with a spade 3,500 plants in eight hours.

A point of very great importance when planting by either method is to see that the soil is thoroughly compacted around the plant; this is especially necessary in dry weather. When the plants are dibbled, this compacting is done by pressing the soil firmly against the plant with the foot, and when ploughed in a heavy roller with a large diameter should follow the planting. A roller with a small diameter will drag the plants up. Whatever method of planting is adopted, if the ground be at all moist, the plants will root without difficulty. It is the practice of some growers to plant on ridges. In cold districts this is probably beneficial, but satisfactory results have been obtained without this trouble and expense.

The subsequent cultivation given to this crop is such as will keep the weeds down and conserve moisture. Cultivation with a small-toothed scuffler may commence as soon as the plants are set out, and can be continued until the vines cover the ground. Other than disturbing the vines whilst cultivating, no attempt should be made to prevent them rooting where they touch the ground.

Harvesting and Storing.

The mature stage can be determined by cutting one of the potatoes. If the cut surface dries white, and does not turn greenish-black round the edge, the potato is fit to eat. If a milky juice exudes which, on exposure to the air, turns black, the potato is not mature enough.

The potatoes will continue to grow until the first frost is experienced; this destroys the vines, and, of course, the tubers will cease to grow after this. The crop may be left in the ground until then, and if the frosts are not very severe, they may be left until they are required, but the vines should be removed, or they will decay and communicate rot to the tubers.

During the last two months of the growing season the yield per acre is very much increased; in some cases it almost doubles itself. Where, therefore, bulk is desired it is well to leave the tubers in the ground for as long as possible after they become fit for the table.

The harvesting is usually done by hand labour. Some diggers prefer to use a pronged hoe, others a digging fork; it is a question of use. With some varieties which produce their roots in clusters around the "plant," the labour of digging may be lessened by throwing a furrow away from each side of the potatoes. When digging, care should be taken not to bruise the roots; a bruised potato rots easily, though a clean-cut one keeps well.

No difficulty has been experienced in storing small quantities of potatoes in dry sand. The tubers on being dug should be allowed to dry in the sun for a few hours, and then placed away in sand, where they will keep through the winter perfectly.

Varieties.

There are several varieties, but only two, White Maltese and Pink, have been grown to any great extent in New South Wales, though one or two others are worthy of mention. The following brief notes on four that are probably the best will be of interest: —

Big-stem Jersey Yellow.—A vigorous and very productive variety. The vines are abundant, with rather large leaves of the ivy shape. The roots are a good shape, yellow in colour. A rather late variety.

WHITE MALTESE

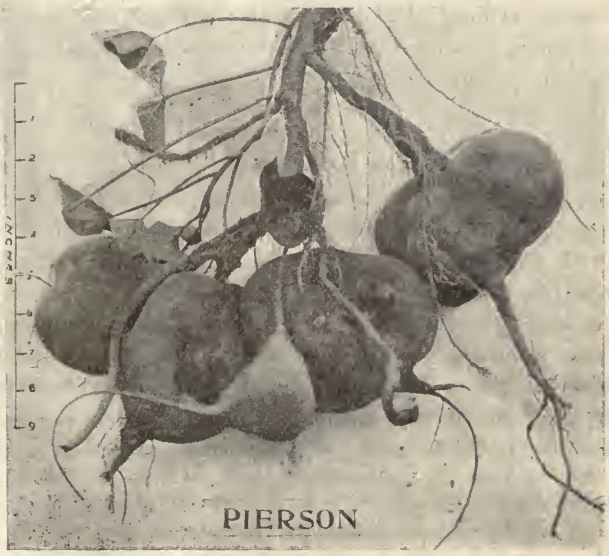
White Maltese.—This is an old reliable favourite. The vine is semi-bushy in character, with little tendency to root at the joints. The leaf is quite distinct in shape from most other varieties, except Bush Vineland. The roots are white in colour, with a tendency to grow very long in loose soil. The roots are of fair quality, somewhat dry, and many weigh 11 lb. each; they keep remarkably well. A mid-season variety.

Pink.—A good yielder, but rather coarse ; more suitable for stock feed than for the table. The growth of vine is not excessive, but the runners attain a great length and root at every joint. The leaf is small and of the usual type. A fair keeper, and a late variety.

Pierson.—A vigorous grower and good cropper. Produces plenty of vine, with large leaves of the ivy type. Roots of good shape, but inclined to crack ; of good quality for the table and keep well ; the colour of the roots is a deep cream. This variety is one of the best of the introduced ones. The roots cluster around the main stem, are attractive and chunky in appearance. An early variety.

Diseases and Pests.

Convolvulus hawk moth (page 113) ; curly top (page 98).



THYME.

See Herbs (page 56).

TOMATO.

The extensive cultivation of the tomato is of comparatively recent years, but it has advanced so rapidly in public estimation as a useful, wholesome, and delicious fruit or vegetable, that very large areas are annually planted with it. In this State the production of early tomatoes for domestic use and mid-season crops for sauce manufacturers is a distinct and profitable business, occupying considerable areas. Our markets consume some thousands of tons of tomatoes annually, the greater bulk being used by the various factories at

which sauce and preserves are made. The method usually adopted is for growers to contract with the manufacturer for the quantity of tomatoes they require.

The best land for tomatoes is a rich mellow loam, with a little sand in the upper layer, and a good clay subsoil. For early crops a northern aspect is desirable. Poor and medium quality lands will frequently give early crops, but not heavy ones. Where this plant is to be grown in quantity for manufacture or the open market, when quantity is of more consequence than earliness, the soil must be either naturally rich or artificially made so.

Having selected the land for this crop it must be prepared during the autumn previous to planting in the spring. If new land be taken it must be broken up and thoroughly prepared. Planting in the open cannot take place until the district is clear of frosts unless means be taken to shelter the young plants every evening. For early crops the young plants must be got ready in a cold frame, in order that they may be planted out as soon as the weather has become favourable.

The Seed Bed.

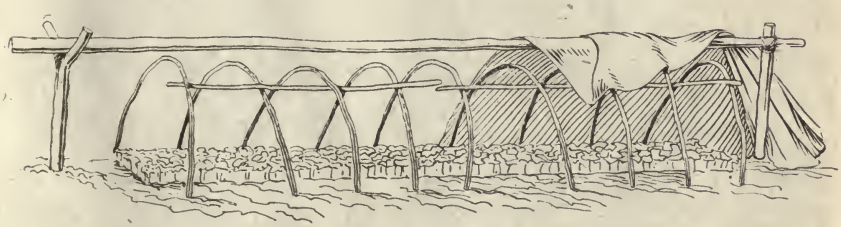
The seed or plant bed may be made of any desired size, according to the extent of cropping. A frame of the required size may be built on this plot, and covered with calico or new hessian ; the latter should be made to shift or roll up, as will be frequently needed The seed may be sown in shallow boxes under cover, or in the frame, and covered with a sprinkling of fine loamy soil. One to two ounces of seed will produce more than sufficient plants for one acre. As soon as the plants are large enough to handle (2 or 3 inches high) they should be transplanted into the frame, which by this time should have been worked up to the finest condition and tilth.

The plants may be set out in rows 5 or 6 inches apart, with the same distance between plants, setting each plant opposite the space in the previous row. Here they remain and grow until time for transplanting into the field, and by removing the calico, giving them air, light, and sunshine on fine days, and covering up in the evenings or during cold spells of frost, they should presently become stout and stocky plants. After they are once set out, do not give them much watering, or they may be inclined to draw up and become lanky and tender.

The main point in a frame or bed of this character is to keep it dry and warm, and in transplanting into it, care must be taken that the plants are not much lower than in the seed-bed, as the deeper they are set the more liable they are to damp off. If any plants have got rather down in the seed-bed, and become long-shanked, they should be laid slanting, just below the surface, and they will take root along the stem, and become stout and stocky plants. The drier the bed is kept (with discretion) the better, as perusal of

the articles describing the fungus diseases of tomatoes will show. When the plants become 5 or 6 inches high, some will want to outrun their neighbours; these should be pinched in a little, so as to allow the weaker plants to come up uniform in strength before putting out. Any suckers that may appear should also be removed if it is intended to grow for early fruit.

For successive crops seed may be sown at intervals in the open, after the frosts are gone. Prepare a bit of rich soil, and strike out drills not more than half an inch deep. Sow thinly, cover lightly, and water sparingly. The young plants should show up within a week, and if it is desired to push them along, transplant into a nursery bed when they get their third leaf, putting them 5 or 6 inches apart as previously advised, and then follow on as before. Seed may be sown from June to end of January, and crops may be grown for eight months in the year—in some favoured spots even longer



Protection from Frost.

Transplanting.

When all is ready for removing the young plants into the field, they should have a good watering some hours before, so that the roots will retain hold of as much soil as possible. Plant at least one inch deeper than in the frame, and if the quantity is not very large, evening is the best time for moving them, or after showers.

It is better to plant in rows 4 feet apart and not less than 3 feet apart in the rows, and to stake them up like vines in a vineyard, instead of letting them trail on the ground, when they do not bear so well and are far more subject to disease. The land should be kept clean between the rows and plants; some growers plant on the square to allow of cross cultivation.

Picking, Packing, and Grading.

Care should be taken when gathering the fruit that it be not bruised, or it will decay rapidly. Tomatoes that are to travel long distances, or occupy days in transit, should be picked when they begin to colour at the blossom end.

When packing, the fruit should be graded according to size and ripeness, all in each package being as near alike as possible. The grading should be as follows:—

1. Large ripe fruit.
2. Small ripe fruit.
3. Large medium ripe.
4. Small medium ripe.
5. Large green fruit.
6. Small green fruit.

The fruit will thus look better, sell better, keep better, and pack or travel better; the arrangement will be found advantageous to the buyer and more profitable to the seller, besides establishing a reputation for the brand

Trellised Tomato Vines at Hawkesbury Agricultural College.

amongst buyers. Each package must have the contents and quality faithfully marked on the outside, so that buyers may learn to rely on the brands without wanting to overhaul the fruit.

Culls should not be marketed, but fed to pigs or destroyed, as is done with other refuse fruit.

Varieties.

There are several good varieties from which the grower can make his selection. Sparks' Earliana is an excellent early tomato that has done well where the vines are trellised. Chalk's Early Jewel is favoured by some growers for the early crop. Burwood Prize, which shelters its fruit beneath abundant foliage, is largely grown in the Hawkesbury district under field conditions for the purposes of the sauce-making trade. Dwarf Champion is

also used for field crops, its strong, upright stems saving the labour and expense of staking. For private gardeners, Ponderosa can be recommended. Other varieties that do well are Bonny Best, Stone, Trucker's Favourite, Matchless, and Early Ruby.

Early Tomatoes at Hawkesbury Agricultural College.

The prices received for tomatoes raised and placed upon the market before the bulk crops come in, more than justify the small expenditure and the considerable amount of light labour required for their special treatment.

At Hawkesbury Agricultural College, a method is adopted that has for years proved this to be true, and as the College is situated in a belt of

General View of the Tomato Vines at Hawkesbury Agricultural College.

country particularly liable to frost, a brief description of the methods employed will no doubt be interesting. For the season 1918–19, a return of £240 14s. was received from a quarter acre plot; 808 half bushel cases being harvested, which had an average value of 5s. 11½d. The actual values ranged from 12s. to 14s. in early December, to 4s. to 6s. on 31st December, and to 6s. to 7s. 6d. at the end of February.

The variety used is Spark's Earliana. Seed is sown about the middle of July, in seed-boxes, and placed in a hot-bed where the growth of the young plants is forced, and they can be covered from frosts at night. When the plants are about 2 in. high they are transplanted into 3-in. pots, and the pots are plunged into the hot-bed, where the young plants can still be protected at night. About the third week of September they are set out in the field.

The plants are put in trellised rows 4 ft. or 4 ft. 6 in. apart, and 15 in. apart in the rows. The trellises are made of 3 in. x 2 in. or 3 in. x 3 in. posts, 9 ft. apart with light 2 in. x 1 in. battens nailed to them, and laths fastened perpendicularly every 15 in. Where long rows can be laid out, it will be cheaper to use wire to support the laths. A tomato plant is set out at the base of each lath.

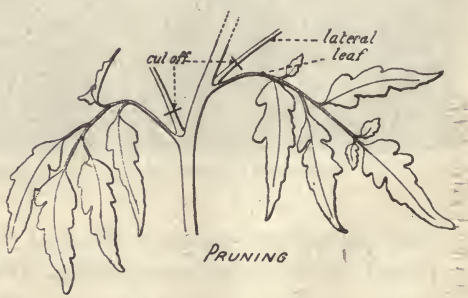
After planting out the weather is watched for late frosts (a peculiar hardness in the air generally indicating a coming frost). In such cases the practice is to put a ti-tree bush on the south-west side of each plant. This shelters the plant from the cold winds, but leaves it open to the sun on the north. No tomatoes have ever been lost by frost.

The following artificial manures are used with great success, being applied at the rate of 3 cwt. per acre :—

	Quantity per half ton.
Sulphate of ammonia	3 cwt.
Superphosphate	4½ cwt.
*Sulphate of potash	2½ cwt.
	10 cwt.

Pruning is the most important operation in the whole process. It is no exaggeration to say that, by careful pruning, the tomatoes are made to ripen a month earlier than they otherwise would.

All lateral growth of shoots is pinched off, leaving only the main stem, which is trained up the lath. A lateral shoot starts from just above a leaf on the main stem. The leaf is not interfered with, but the shoot is pinched off as close to the stem as possible without damaging the leaf (see accompanying figure).



The trusses of bloom which give the fruit are thrown out along the main stem. Care is to be taken not to injure these when pruning. When the main stem reaches the top of the lath it is pinched off, but not before. This pruning is practised regularly about once a week. Whenever laterals appear they are pinched off.

* At the present time this salt is unobtainable, but the potash in the fertiliser can be supplied by using a similar quantity of muriate of potash, or by means of wood ashes added to the soil two or three weeks previously, 13 to 14 cwt. of wood ashes being equal in potash content to 1 cwt. sulphate of potash.

The tomatoes start to ripen from the base of the plant, and the ripening proceeds gradually towards the top.

The tomatoes are sprayed occasionally to check black spot, Bordeaux mixture being used at the summer strength. This is prepared from copper sulphate, 6 lb ; lime, 4 lb.; water, 50 gallons.

Diseases and Pests.

Black spot (page 94) ; early blight (page 101); late (or Irish) blight (page 102); ripe rot (page 106) ; wilt (page 109).

A physical condition known as " sunburn " is also referred to on page 109.

Cutworm (page 114) ; eelworm (page 118); Rutherglen bug (page 123); tomato and bean bug (page 124) ; wireworm (page 127).

TREE ONION.

The tree onion is a variety of multiplier onion, which, in addition to forming " cloves," as with the potato onion, produces clusters of small bulbs on the tips of the stalks, which are used for pickles. The cloves at the bottom of the plant (smaller than those of the potato onion) may be used for propagating, as well as the small bulbs obtained from the top ; these latter being planted about March. The large bulbs produced at the bottom of the plant are bad keepers and should be used quickly. Some strains of this class of onion produce extra tall tops, and in all cases it is necessary to give plenty of room between the sets when planting.

Diseases and Pests.—See list attached to onion (page 67).

TURNIP AND SWEDE.

Almost all soils are suitable for the production of Swede turnips, the governing factor being more the supply of moisture than the richness of the land. The turnip is a shallow rooter, and every effort must be made in the cultivation of the soil and in the application of manures to retain the plant-food near the surface where it can be readily drawn upon by the crop.

The land should be ploughed or dug deeply, and brought to a fine tilth. This is essential to ensure the proper germination of the seed. On very loose soils the hand-sower at times shows an inclination to run too deep, and in order to lighten the work it is advisable to use the roller to compact the seed-bed. In most parts of the State it will be found that December to March sowings will produce the best results. Swedes do not do well in New South Wales when sown early in the summer, the crop being one that is native to cool conditions. The attacks of aphis in summer time also contribute to failure, while the heavy moisture requirements of the crop further demand that it shall be grown at a time when the rainfall is most regular. Autumn sowing avoids the hot weather and the attacks of aphis, and allows the development of the roots at a time when the rainfall is usually more regular, and the evaporation very much less.

White turnips can be grown at almost any time of the year, except in midsummer, though in vegetable gardens where water is available there is no need to avoid even that short period. The sowings of these varieties, however, should only be sufficient to cover the immediate requirements of the season, especially in hot weather, as they readily run to seed.

In the coastal and tableland districts 1 to 2 lb. of seed per acre is generally sown in drills about 2 feet 6 inches apart, and 3 lb. to 4 lb. broadcast. In the drier districts a smaller quantity of seed, say 1½ lb. drilled per acre, would be ample.

The results of experiments with fertilisers for Swede turnips go to show that a supply of soluble phosphoric acid is very essential to the crop, owing, not so much to the quantity taken from the soil as to the peculiar inability it appears to have, in comparison with many other crops, of utilising the supplies naturally existing in the soil. Superphosphate, applied at the rate of ½ cwt. to 1 cwt. per acre, supplies a readily available form of phosphoric acid, and the crop responds to its application with a largely increased yield. It has a marked effect upon the young plants, inducing a vigorous, healthy growth from the very start; indeed, no crop is more readily benefited by the application of this useful fertiliser.

As soon as the young plants are about 1 to 2 inches in height, it is advisable to thin them out; for a field crop the plants should be left 6 to 8 inches apart in the drills. The thinning out is best done by hand or with a sharp hoe. The soil between the drills must be kept well loosened.

The recommended varieties are:—

Turnips.	*Swedes.*
White Stone,	Purple Top,
White Nepaul,	Skirving's Purple Top,
Red-top Stone,	Laing's Garden Swedes.
Early White Milan,	
Orange Jelly.	

Diseases and Pests.

Black rot (page 93); club-root (page 97); downy mildew of cabbage (page 99); white rust (page 109).

Aphis (page 110); cabbage grub or cabbage moth (page 115); cutworm (page 114); eelworm (page 118).

VEGETABLE MARROW.

See Pumpkin (page 73).

WATER-MELON.

See Melon (page 59).

Fungus Diseases.

G. P. Darnell Smith, D.Sc., F.I.C., F.C.S., Biologist.

Most diseases of plants are caused by low forms of vegetable life known as fungi, which live upon and within the tissues of the higher plants. The main difference, other than size, between the fungi and the higher plants, is the lack of the green colouring matter so abundant in the higher order of vegetation. The methods of development in the fungi are often different from those of higher plants, and their microscopic size renders their study more difficult. The parasitic fungi spend the winter months mostly within the living and dead vegetable tissues, and during the early spring days send out small spores, which correspond to the seeds of the higher plants. These spores are disseminated by the wind and other agents from plant to plant. With favourable conditions as to moisture and warmth, the spores send out small branches, which penetrate into the living tissues of the higher orders of plants. By the application of a fungicide to a plant, we destroy the spores which have found lodgment upon it, and thus prevent the development of additional spores, which would cause disease. Just as long as the tissues of plants are covered with a thin, even coating of fungicide, very few fungi can develop upon them. Thus, if a fungicide were applied at regular intervals during the growing period, most of such plant diseases would be held in check. To the vegetable grower, however, this is scarcely practicable, and the application of the fungicide should begin immediately the disease has advanced far enough to manifest itself to any extent.

Anthracnose or Pod Spot of Beans.

The disease known as anthracnose or pod spot is caused by a fungus and occurs all over the world wherever beans are grown, often doing very serious damage. It attacks pods, stems, and leaves, but the most conspicuous injuries are the spots on the pods. The fungus penetrates the affected parts to a considerable extent, and the seeds in the pods beneath the spots are often spotted or discoloured, so that the fungus is readily distributed by the use of infected seed. It appears upon the seedling leaves of the young plants when badly infected seed is sown. The fungus spreads from the seed leaves to the first-formed true leaves of the plant. The stems of plants are often so badly diseased near the base that they may fall over and die. The pods, when quite young and succulent, offer the best conditions for the growth and development of the fungus, which develops best with continued wet weather or with heavy dews.

Spores from diseased spots on stems and leaves may fall on the pods, where in the presence of moisture and a sufficiently high temperature, they germinate rapidly and produce the spots, which enlarge and darken until nearly black. The dead tissue dries and shrinks. Spores are produced by the fungus in these spots in great abundance, and ooze out, forming pink masses held together by a mucilage, which when dry, sticks them to the spot. When dew or rain falls on these spots the mucilage is dissolved and the spores set free in the water. At this time any disturbance of the bean plant will scatter these spores to other plants, and for this reason beans should not be cultivated nor handled in the early morning while the dew is still on them or after a shower.

Since diseased pods and stems left in the field provide infection for the new crop, all diseased plants, leaves, and pods should be collected and burnt. Only clean seed should be used in any future planting; it should be obtained from some source known to be free from disease.

These are the best preventives, and if they are rigidly carried out the new crop may be free from disease.

As a further precaution all seed should be disinfected. The most satisfactory dip is a solution of about 1 oz. corrosive sublimate or mercuric chloride in $6\frac{1}{4}$ gallons of water. The seed should be soaked in this for ten minutes. This method of disinfection is also of great service in checking other diseases.

A rotation of crops (see page 22) and spraying with Bordeaux mixture (see page 128) have been found to keep the disease in check, but it is best perhaps to pull up and destroy a crop affected with this disease.

Soil well fertilised with stable manure some time previous to planting has been beneficial in promoting active plant growth and also reducing disease. The grower should also be on the look out for resistant varieties—selecting seed from any plants that show resistance to the disease at any time. The wax podded varieties are less resistant than others.

Asparagus Rust.

This disease does not attack the shoots which are cut for market, but is found on those green ones which are allowed to develop after cutting has ceased. Affected tops become reddish-brown in colour, and on the stems numerous small, reddish, pustules appear. These contain the spores of the rust fungus. In severe cases the tops turn yellow and the needles fall prematurely. The plant, therefore, fails to manufacture and store up the necessary foods resulting in a reduction of subsequent yields.

The occurrence of the disease is closely allied to certain weather conditions. Rust is most frequently found during seasons of insufficient rainfall, or on soils which dry out rapidly; hence it may be kept in check by irrigation

where possible. Heavy dews are also necessary for the spread of the disease, and by planting on higher and more exposed levels less subject to dew the spread may be prevented. American horticulturists claim to have produced a variety which is resistant to the disease. This distinction does not yet apply to any variety at present in cultivation here.

Black Leg of Cabbage and Cauliflower.

This disease occurs on cabbages and cauliflowers, especially when young. Infection frequently takes place on the stem at the surface of the ground, just below the junction of the leaves, and also at the margins of the leaves. The disease spreads downwards to the roots and around the stem, often completely girdling it, giving it a black appearance—hence the name. Often the fibrous roots and the lateral roots are killed. Before the plant dies, a purplish tint is developed in the foliage, and persists until the plant dies. Wilting of the plant is very characteristic, the leaves adhering to the stem and drooping. Sunken spots occur on the leaves, and later these dead areas become covered with numerous minute black specks. The fungus is harboured for the most part in the soil on decayed stems and leaves of plants.

The best control measures are preventive; all refuse of present and past crops should be collected and burnt.

Seed-beds can be sprayed with weak Bordeaux mixture (see page 128), and only clean seedlings should be planted out.

Black Leg of Potato.

This disease, also called black stalk rot, has been met with once in New South Wales, and it also occurs in Victoria. The seed tuber begins to rot early, sometimes before the sprouts break through the ground. The rot spreads up the base of the stem, which turns quite black, shrinks, and rots as far as the surface of the soil, and often above it. This is the best indication of the disease. As a result of this injury, the whole plant begins to die, generally without setting any tubers. Wet and cold weather apparently favour the disease. Other plants, such as turnips, swedes, carrots, and parsnips are also attacked. As it is practically confined to the underground parts, the disease may be greatly controlled by carefully digging out and burning all diseased plants. Selection of seed and dipping in formalin as recommended for Rhizoctonia (page 106) also assist in preventing its introduction.

Black Rot of Cabbage and Cauliflower.

This disease, popularly known as black rot, but sometimes as dry rot brown rot, black stem, black vein, &c., is a bacterial one. Cabbage, cauliflower, kale, kohlrabi, turnip, swede, and radish are all liable to attack, but the following account refers more particularly to cabbage and cauliflower.

The plants are attacked in all stages of growth. When young plants are attacked early and severely they may be destroyed in a few weeks. The severity varies with the season. In moist weather the disease may destroy an entire crop. In ordinary weather it may take several months to cripple the plants or destroy a crop. Infection takes place through wounds, but more often through the water pores on the margins of the leaves. The bacteria often commence development in the drops of water exuded by the leaves, and then enter through the pores. They rapidly multiply and spread through the veins of the leaves, and finally travel down the leaf stems and the stem of the plant. The affected area of the leaf becomes dry and leathery, and the veins have the appearance of black streaks. In the thick leaf stems the black streaks may not show from the surface, but on cutting across or along them the streaks will usually be seen. Often a part of a leaf or one side of a plant only will be attacked, and the black streaks can then be traced down the corresponding side of the leaf stalk and stem of the plant. Dwarfing, one-sided growth, yellowing of foliage, gradual loss of leaves, and brown streaks in the leaves, are the chief symptoms of the disease. The gradual and successive shedding of the leaves often result in the production of a long, dry stem with the conspicuous scars of the many cast-off leaves upon it.

In ordinary weather, the picking off and burning of all affected leaves helps to check the disease; but when the plants are about ready for market, no time should be lost in harvesting them, as they will not keep. It has been proved that the bacteria are capable of living for months (even a year) on the surface of the seed, and that infection is spread in this way.

The chief methods of prevention are: Disinfection of the seed for fifteen minutes in a solution of formalin 1 part, water 250 parts; or corrosive sublimate 1 part, water 1,000 parts. The latter is a very strong internal poison, and must be handled with care. All insects should be kept down, to prevent them spreading the disease, and if a field is infected, all refuse of old, diseased plants should be collected and burnt—not buried—and a crop rotation (see page 22) practised.

Black Spot of Tomato.

The "black spot" disease of the tomato is very common in New South Wales, and probably no tomato disease causes greater loss.

Black spot usually makes its appearance first at the flower end of the fruit as a small brown discoloration. The discoloration spreads, and the spot becomes more distinct and definite in outline; at the same time it becomes depressed and darkens in colour. The larger spots, which may be an inch or more across, have a dark-brown or black appearance, and are often

somewhat velvety in texture. Later the whole blossom-half of the fruit may be involved. The affected tissue collapses and becomes firm and leathery. This collapsing of the diseased tissue, together with the continued development of other parts of the fruit, may produce a definite depression on the blossom end of the fruit, or often it results in only a flattening of the surface.

The first effects of the disease are not always superficial. In fruit that appears normal from an external view the interior tissue may have collapsed and be blackened in the parts nearest the blossom. The velvety appearance that develops on the surface later is due to a growth of a fungus which is not, of itself, capable of producing the rot, and is apparently a secondary infection. The disease is not due primarily to bacteria or fungi, but to various physiological conditions, and is not infectious.

Experiments indicate that water supply is of the greatest importance in the production and the control of black spot. The disease has been produced on vigorous plants by a sudden decrease in the available water supply. Excessive water supply has also produced the disease more readily and uniformly than a scant or intermittent one. Plants receiving a moderate and regular supply of water develop less rotten fruit than either lightly or heavily watered ones. Too much exposure to the sun also tends to an increase of the disease, so that methods of growth that allow for the foliage shading the fruit, assist in checking the appearance of rot.

The effects of fertilisers on the production of the disease vary with the nature of the soil and the amount of water supplied. Experiments by Brooks in New Hampshire, U.S.A., gave the following general conclusions :— "Lime is of value in reducing the disease, especially if the plants are well watered, but under drought conditions it has little tendency to decrease the disease; potash has no tendency to increase the disease, but nitrogenous fertilisers favour its development. Heavy applications of stable manure increase the disease out of proportion to the increased vigour of the plants."

As the disease is not primarily due to fungi or bacteria, spraying will not control it.

Brown Fleck of Potato.

This is a fairly common condition. Tubers that to all external appearances are healthy and sound, when cut open show rusty markings of various sizes and shapes. These discoloured areas consist of dead tissue, and must not be confounded with blight. In the latter case, the diseased parts are, at least at first, immediately beneath the skin, whereas in brown fleck the markings are more internal, scattered, and usually not in contact with the skin. No signs of disease are to be found on the stem or leaf parts of the plants which produce such tubers, and the cause of brown fleck is not

known. It is not hereditary, for the disease does not necessarily appear if seed affected with brown fleck is planted. Many conditions relating to the nature and composition of the soil, amount of moisture, and weather, have been investigated as contributing causes, but no definite conclusions have been arrived at.

Brown Fleck.

Brown Rot of Potato, Tomato, &c.

The cause of this disease is a bacterium which attacks potato, tomato, tobacco, and egg plants. On cutting across an infected branch of the plant brown discolorations are seen, and a dirty white slimy mass may ooze out from the cut surface. As the infection spreads, the stem turns prematurely yellow, shrivels, and wilts, or it may wilt suddenly without loss of green, colour, and the whole plant may soon collapse. The accompanying brown stain can often be seen through the younger and more translucent stems as long brown streaks, although the surfaces of these parts still appear to be normal. The roots, as well as the stems, are subject to attack.

In the tuber itself, infection first shows as a browning of the vascular ring at the stem end, and on cutting across, the dirty greyish bacterial slime may ooze out.

Infection may take place in two ways : (1) If slightly infected potatoes are used for seed (the disease will not be noticed unless the tubers are cut), the bacteria are able to spread to the growing plant ; (2) leaf-eating insects feeding on diseased plants can transmit the disease from plant to plant. Thus, the chief means of control are careful selection of seed, and spraying to keep down insects. The disease has been very rare in New South Wales ; in fact, its actual existence here is questioned.

Brown Rot, or Bacterial Rot.

Club-root of Cabbage and Cauliflower.

Plants affected with club-root are characterised by swellings of the roots, sometimes to as large as two fists. Few or no lateral roots are formed. The affected plants have a wilted appearance during the day, but recover at night. Plants are generally attacked when young or in the seed-bed, and when so affected have a stunted and sickly appearance and seldom grow to maturity. The malformations may be confused with root-knots caused by eelworms (or gallworms), but these as a rule are not so large as the malformations associated with club-root.

The cause of the disease is a small parasite which lives within the cells of the roots of certain plants, especially these belonging to the natural order, Cruciferæ.

The parasite is confined either to the soil or to the underground parts of the plant, and therefore sprayings of any kind are of no use against this disease. The majority of Cruciferæ are susceptible, but it appears that varieties of cabbage vary in their susceptibility. Soils of an acid nature are

Club-root of Cabbage.
(*Plasmodiophora brassicæ.*)
Photo by Bureau of Microbiology.

favourable to the development of the parasite. Lime is the most valuable substance to use to check it. Applications of two to four tons per acre are recommended, after all refuse of diseased crops have been removed and burnt—not buried. Seedlings should be carefully examined, and, if they show any signs of club-root, should be burnt. As the soil may remain contaminated for some time after the crop is attacked, a rotation of crops (see page 22) should be carried out.

"Curly Top" of Sweet Potato.

This disease shows itself in the early stages of the growth of the plant, generally in isolated plants throughout the crop. Minute tubercles, which are at first the same colour as the leaf, are produced on both sides of the leaves and on the stems and roots. Later, the leaves turn black and the whole plant wilts.

In districts where this disease occurs, it is found that by planting in the warmer months the vines grow more vigorously and are less susceptible to the disease. The sweet potato is a tropical plant, and the ground is apparently not warm enough in the early spring to produce a sufficiently rapid and vigorous growth.

Downy Mildew of Cabbage and Cauliflower.

This disease produces white to greyish, felt-like patches on the leaves and stems. The destruction of all plant refuse, and the reduction of the amount of moisture on the plant by the free access of air and light, will check the disease, and spraying with Bordeaux mixture (see page 128) is recommended.

Downy Mildew of Pumpkin, Melon, &c.

This disease appears first in the form of spots upon the older leaves, near the centre of the plant. The spots become more distinct and enlarged, gradually encroaching on each other and forming large patches. The affected leaves become pale and sickly, and soon shrivel up and die. The disease progresses to the younger leaves, slowly in dry weather, but very rapidly in warm, moist weather, and a field may soon be reduced to a mass of dead leaves, as if killed by frost.

After its appearance the disease is not readily checked; but by early spraying with weak Bordeaux mixture (see page 128), it may be prevented from commencing its infection.

Downy Mildew or Onion Blight.

The disease of onions referred to as blight, mildew or mould is caused by a fungus. This disease is closely allied to the late (Irish) blight of the potato, and resembles it in the rapidity of its spread through an infected field. It may first be noted in a field in one or two definite areas, and recognised by the leaves appearing, as if splashed with scalding water.

During warm damp weather, the disease spreads rapidly and destruction is complete. Examined in the early morning parts of the diseased leaves appear a peculiar violet tint, due to the furry covering of mildew. The fungus lives in the tissues of the leaves; when weather conditions are favourable, spores are given off which are readily scattered by wind and rain and are able to infect a healthy leaf within an hour. Thus the area of infection is spread at a remarkably rapid rate.

Spores are able to remain dormant during the winter until favourable conditions return in the spring, when germination takes place and the new crop is infected. These spores pass the winter in the dead leaves left in the field. If they could be destroyed at this stage the disease would not reappear. The raking up and burning of all old leaves from a crop than has been

attacked should be carefully carried out, and though this will destroy many, large numbers will still remain in the soil and in small pieces of broken leaves. As these retain their vitality for a year, or even two or more years where blight is severe, a rotation of crops (see page 22) should be practised.

The first injury from this disease is the loss of leaves, but if the weather becomes unfavourable to the fungus after an attack has commenced, the affected plants may recover and produce sufficient new foliage to carry the bulbs to maturity, especially if the attack has been early. Spraying with weak Bordeaux mixture (see page 128) should be done to prevent infection. When the early appearance of the disease is noticed only in isolated areas, several thorough sprayings should be given to these areas first. Sprayings to prevent infection should be commenced early and given about every four weeks, but, in rainy weather, about every two weeks.

Anything that tends to weaken the onions, such as too much moisture or shelter, should be avoided. Seed should be free from bits of leaves and stems which may harbour the disease, and before sowing should be soaked for half an hour in a solution of formalin 1 part, and water 200 parts. This will also prevent the introduction of onion smut, which does not yet occur in New South Wales.

Dry Rot of Potato.

A very common form of potato disease is a dry, whitish, crumbling condition of the tubers. If such tubers are kept dry they mostly shrink up and become hard, whereas if kept at all moist, or stored in a damp place, they soon become covered with an abundant, white, felt-like growth of fungus-threads. Investigations have proved that this dry rot can be produced by many species of *Fusarium*, some of which are true parasites and can entirely destroy the tubers, while others cannot by themselves destroy the tubers, but only assist in the destruction after the tubers are attacked by other fungi and bacteria. The species causing dry rot are not the same in all countries, and although some occur in both Europe and the United States of America, others are confined to one or other of those areas. Where there is any suspicion that the seed may be diseased, it would be advisable to cut all tubers, and any showing a brown ring under the surface should be rejected, as also should those showing any signs of surface rotting. As the fungi can live for some time in the soil, badly infected areas should have a rotation of crops (see page 22).

Early Blight of Celery and Parsnip.

This disease, as its name infers, occurs early in the season, and produces a more defined spotted appearance than the late blight (see page 102). When the spots become numerous on a leaf it begins to turn yellow, and assumes a characteristic ashen colour and velvety appearance. When a leaf becomes badly attacked it wilts and dries, and numerous spores are produced over the surface, particularly during muggy weather.

Early spraying with weak Bordeaux mixture (see page 128) will control this isease.

Early Blight of Potato.

The fungus causing this disease may attack the plants at any stage of their development. The disease usually appears first on the lower leaves, in the form of small brown or black spots, which later increase in number and size, becoming irregularly circular in outline, and often exhibiting concentric markings. Sometimes the spots may fall out, producing a "shotbole" appearance. The leaves eventually curl and die. Brown or black spots, more or less circular and slightly depressed, may develop on the stem.

The disease does not damage the tubers, but by destroying the haulms, decreases the yield. Abundance of spores are produced on the dead spots and spread the disease. The fungus probably passes from one season to another on old diseased parts of the affected plant.

In the control of this disease the destruction by burning of all parts of old plants is the first consideration. Very often after a crop the refuse of old plants is turned under, and in this way a resting place is afforded for the fungus. Spraying with Bordeaux mixture (see page 128) should be regularly carried out to prevent infection. If the disease is serious in any year a rotation should be practised, but potatoes should not follow nor precede the tomatoes.

Early Blight of Tomato.

The appearance of this disease on the stems and leaves is similar to that described for early blight of potato. With the tomato, however, the fruit also may be attacked, either while on the plant or after picking; brown or black spots appear on the surface and the disease may grow into the interior of the fruit and rot it.

For control measures, see early blight of potato.

Late or Irish Blight of Potato.

This disease may attack any portion of the plant, and may appear at any stage of its growth. The leaves become yellowish-green in colour, and then irregular brown patches are developed, commencing at or near the tips and edges. On the under surface of the leaf, these are seen to be surrounded by a delicate white or greyish mould.

If the weather remains cool and damp, the patches rapidly enlarge and turn black, the plants then appearing as if they had been killed by frost. Finally the whole plant wilts, becomes black and rapidly decays.

If a warm dry spell occurs soon after infection the disease is checked, the brown spots do not then enlarge, but become brittle, crack, and dry up. The tubers are sometimes attacked by spores of the fungus which are washed through the soil by rain. Tomatoes and potatoes are often grown in the same area, and thus the fungus finds a living host throughout the whole year.

The most satisfactory control measure consists of systematic and thorough spraying before the appearance of the disease, with Bordeaux mixture (see page 128). It is also advisable to use seed from a crop which has been free from the disease.

Late or Irish Blight of Tomato.

The fungus causing this disease also attacks the potato as previously described, and its method of attacks on stems and leaves of tomato plants is similar, but it is not as a rule of serious consequence amongst tomatoes. The symptoms on the leaves and stems are similar to those described on the potato for late or Irish blight. Fruit in all stages of ripening may also be affected, the disease appearing in the form of dark spots which may continue to develop after picking and cause rapid decay. Very young plants are sometimes attacked.

Systematic spraying with Bordeaux (see page 128) mixture will prevent infection.

Leaf Blight of Tomato.

This disease is caused by a fungus, which attacks the stem, fruit and calyx, and more especially the leaves. It produces small circular brown spots on the lower leaves, and if these are seriously affected they turn yellow and die. If weather conditions favour the fungus, the attack progresses upwards, and in severe attacks little of the plant may remain but bare stems and small stunted fruit. The withering of the leaves makes the attack look like that of Irish blight, but the spots on the leaves distinguish it from other diseases. Affected leaves have a tendency to curl dorsally throughout their length, and may hang loosely on the stem. With severe attacks, old leaves may be killed faster than new ones are produced, and the plant is finally checked to such an extent that little fruit is produced, or what has been produced may be ripened quicker.

The fungus lives through the winter in old fallen leaves and other parts of the plant. Thus in controlling the disease all such refuse should be collected and burnt.

The disease often attacks young plants just after setting out in the field. Bordeaux mixture (see page 128) promptly sprayed on the plants after the disease appears will check it. Spraying, however, should be considered as a necessary operation in tomato-growing, and not be delayed until some disease makes its appearance.

Leaf Spot of Beans.

A disease that has recently appeared on French beans is that known as leaf spot. The fungus which causes it, attacks the leaves and stems, producing brownish patches, and causes the leaves to fall away. The spots become large and angular, being often limited by the veins. Spraying with weak Bordeaux mixture (see page 128) is recommended for its control.

Leaf Spot or Late Blight of Celery.

This disease is frequently overlooked or neglected in its early stages, and not noticed till later in the season, when its ravages have assumed epidemic form. The first signs are small discoloured areas on the foliage, mostly on the lower outside leaves. By holding up the leaf to the light, and looking through

it, dark spots can be noticed. These often form in clusters, and increase in number and size, until they join up at their margins, and the whole leaf becomes a dirty greenish brown colour, and withers away. The spots may appear on the upper or the lower surfaces of the leaves, and the leaf stalks may also become affected. Inner leaves may be found to resist the disease for a time, but under warm and moist weather it spreads rapidly from the older to the younger leaves, and the whole plant is rendered useless. Small black points, from which spores are produced in moist weather, appear on the brown dead areas. The blight usually appears after rain or heavy fogs, and spreads rapidly with a plentiful supply of moisture. If diseased plants go to seed the fungus also attacks the seed, and passes the winter in it unharmed, giving rise to actively infectious spores in spring. Seedling plants may show the characteristic spots on the leaves at a very early age. The fungus also passes the winter on diseased foliage and stems.

Preventive measures should commence with the seed. This should be steeped for three hours in a mixture of formalin 1 part, water 600 parts, frequently well stirred and then taken out and dried. Weak Bordeaux mixture (see page 128) should be applied to the plants in the seed-bed.

Care should be taken that only healthy plants are transplanted, and the first field spraying should be given about four to six weeks afterwards. Thereafter spraying should be given at periods of three or four weeks, but more frequently in wet weather. Until the plants reach a height of about 15 inches, spraying may be done, travelling in one direction only, but when above that height the spraying should be done twice, proceeding the second time in the opposite direction to the first time, thus completely covering both sides of the plants. The quantity used by this method is found to be about 30 to 40 gallons per acre. Before spraying, go over the rows and remove all dead or badly affected leaves and burn them. Diseased plants or refuse from a previous crop should not be left in the field.

Where the disease has been serious, rotations should be made, extending over several years. Recent experiments have shown that varieties vary in their resistance to attack, so that careful observations should be made as to those most resistant under the local conditions, and cultivation confined to the least susceptible varieties.

Mildews of Beans and Peas.

Beans and peas are attacked by a number of fungi which produce diseases known as mildews.

Damping-off Mildew.—The conditions which favour the development of this disease are a considerable degree of warmth, abundant moisture, and a crowded condition of the seed-bed. Plants are mostly infected by means of water which is drawn from a source where the fungus is present. This may be overcome by watering from a tank supply. Precautions may be taken against another source of infection, the seed-bed itself, by sterilising the

soil by steam or fire (see page 132) before the sowing is made. The fungus attacks the seedlings at or near the surface of the ground, the stem shrinking and the plants falling over. Thinning out seedlings, reducing the water supply, and allowing the free access of air and sunshine to the fungus will check the further development.

Downy Mildew.—The fungus which causes this disease attacks the leaves, producing felt-like patches which become dense and whitish to greyish in colour and spread rapidly in moist weather. The spores can live from one season to another in any decaying parts of the plant. The destruction of all plant refuse, the reduction of the moisture on the plants by the access of sunshine and the free circulation of air will check the disease. Spraying with weak Bordeaux mixture (see page 128) is recommended.

Powdery Mildew.—This disease which is caused by a fungus is very common. On peas in moist seasons it may form a dense mass of fungus matter, covering stems, leaves, and pods. When mildew attacks young plants the crop is generally a total failure. The fungus may hibernate in the seed derived from affected pods.

Spraying with weak Bordeaux mixture (see page 128) is recommended.

Pea Spot.

This disease attacks French and haricot beans, and garden peas. The first indication of attack is the appearance of pale green spots of variable size and irregular shape on the pods. These spots continue to increase in size, and eventually become whitish, bounded by a dark line, and dotted with minute black points. The fungus may grow through the pod into the seed and reduce its germinating power as well as carrying the fungus over to the succeeding crop, thus furthering its distribution. Similar spots may occur on the leaves and stem, and often penetrate through the woody part, causing wilting of the plant.

On young plants the disease often assumes the character of a "damping-off" disease. Spraying with weak Bordeaux mixture (see page 128) on the first appearance of the disease checks its spread. As the disease is also distributed in affected seed, careful attention should be given to the selection of good seed, free from any disease spots.

Powdery Mildew of Pumpkin, Melon, &c.

This fungus disease appears as a whitish, flour-like growth on the leaves and stems, at first forming circular spots, which soon enlarge. It is distributed by wind and rain, and its effect is to render the fruit bitter and to distort it.

All old plants and parts affected should be collected and burnt, and if the attack is severe, rotation should be made, or the crop grown on fresh ground. As in the case of most powdery mildews, sulphur and its compounds are the best checks. On small patches, dusting with dry, powdered slake lime and sulphur is effective. On a larger scale, spraying with weak Bordeaux mixture (see page 128) must be resorted to.

Pumpkin-blossom Tip Rot.

The cause of this disease is a fungus, which produces an appearance closely resembling that caused by the black rot fungus of the tomato. The first indication of an attack is the appearance of a dark colour near the tip of the young pumpkin, where the withered blossom still clings. This colouration extends backwards, and long before it is ripe the fruit is a worthless rotten mass. The colour of the rot, as it shows on the surface, varies according to the plant attacked. Near the base of the withered blossom the colour is black or dark-green, and velvety, and it is here that the surface of the fruit first becomes shrivelled and wrinkled. A little farther from the tip of the fruit the rot is dark-brown, and this shades off through light-brown into the healthy colour of the rind of the fruit. This description is of a half-rotten squash about half-grown. When the destruction is more rapid, and the fruit is killed while very young, the appearances are somewhat different.

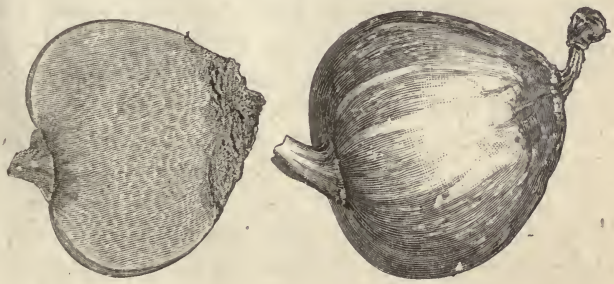


Fig. B. Fig. A.

A Squash, showing effects of squash-blossom and squash-tip disease.

Fig. A shows a squash whose tip is discoloured and rotten on account of the attacks of the disease.

Fig. B shows the same squash cut open, so as to show the progress of the disease in the tissues the young squash. The diseased tissue appears spongy and darker coloured.

When split in halves, so as to show the changes in the flesh due to the disease, all that portion of the fruit near the tip will be seen to be discoloured and spongy; where the outside is seen to be discoloured by the rot, it will be noted that the flesh has changed to a brown or ochre colour. The mycelium, or "roots" of the fungus, extends as far as the brown or ochre colouration, and is found more particularly near the surface.

Accompanying the dark-green velvety-appearance produced by the fungus near the tip of the fruit, a snowy-white or pinkish growth is usually seen on the surface of the rotten part.

No remedies have, up to date, been devised for this disease. Dr. Cobb suggested that as the disease manifests itself almost as soon as the blossom has set, all such blossoms should be pinched and prevented from fruiting.

Pumpkin-leaf Oïdium.

This disease of pumpkins, squashes, and melons is caused by a white and powdery or mealy fungus which blights the leaves, causing them to turn first yellow, then brown, and finally to die.

Where practicable burn or otherwise destroy affected material; do not plough it in; practise a rotation of crops (see page 22). Do not grow pumpkins two years in succession on the same land; when possible, put them on new land. Weak Bordeaux mixture (see page 128) is often beneficial when applied as a spray.

Rhizoctonia of Potato.

It is quite common to find on the surface of tubers dark-brown lumps of irregular shape and size, like small lumps of soil, but which become black and show up distinctly in contrast to the potato skin when wetted. They do not adhere very firmly to the skin, and can be scratched off with the finger nail or easily rubbed off; when removed they leave very little scar on the skin. This condition is sometimes called black speck scab. Sometimes, however, the lumps may be found to be deeper in the tissues, and even beneath the skin. The stem of young plants are often rotted round the collar or beneath the soil. Some die from what appears to be a wet rot.

Various other conditions have been found associated with this fungus, such as a bunching or rosette appearance of the tops and small potatoes formed on the stem above the seat of injury, and sometimes in the axils of the leaves along the stem. Such unusual growths, however, may be caused by many other conditions, and must not be taken as absolute indication of the presence of rhizoctonia.

Besides causing the death of plants, the fungus also produces a rotting of the tubers. This typically consists of a dry brown rot, which extends inward from the skin, and very much resembles the true rot produced by late blight when bacteria are absent. This condition is common in Tasmanian potatoes, and is known as brown rust.

The remedy is selection of seed and the dipping of all seed before planting. The following treatment is recommended:—

Dip the tubers in hot formalin (2 pints 40 per cent. formalin in 30 gallons of water) at 118–122 deg. Fah. for 2 minutes. Then place in a heap 6 to 8 inches high, cover with wet bags and leave them for an hour. Remove the bags and allow the potatoes to dry.

The seed is best treated in half-bushel lots in a sack. A thermometer and a small boiler or tub of about 15 gallons capacity are required.

Ripe Rot of Tomato.

This disease usually appears when the fruit is ripe or nearly ripe. It is due to a fungus, which may cause loss even after pulling, as the rot may spread and affect fruit carried in contact with the diseased fruit in the case.

Large, sunken, decayed spots appear, which become covered with small dark spots, formed in concentric rings. Later, the spots become white to pinkish as the spores are produced and forced out over the surface of the diseased area.

The fruit should be handled carefully to prevent any injury, as spores readily infect sound fruit if the skin be damaged. On no account should a tomato showing signs of ripe rot be included in a case of sound fruit. Rotation (see page 22) will act as a control, and diseased specimens should be all absolutely destroyed.

Rust of Beans and Peas.

Several species of rust fungi attack beans and peas throughout the world, and one is common on our varieties of our garden beans. The fungus usually appears late in the season and is destructive to the foliage, resulting in an earlier and a reduced crop. At first, small and blister-like spots appear on the leaves (usually on the under surface, though occasionally on the upper). These rupture, and the spores produced give an iron-rust colour to the mass. The fungus is harboured by the old leaves and vines; hence, when this disease appears in a crop it is advisable to burn all refuse and neither to throw any on the manure heap to be returned later to the field, nor to turn any under the soil. Early spraying with weak Bordeaux mixture (see page 128) should be given. Later, when the pods are well developed the English practice is to use permanganate of potash, about 1 oz. in 8 to 10 gallons of water. The grower should always be on the look-out for seed from any resistant varieties.

Another of these species of rust fungi has been recorded in New South Wales on broad beans. It attacks pods, leaves, and stems, and in other parts of the world occurs on garden peas.

Scab of Potato.

The confusion in the use of the word "scab" is so great that it would be better to drop it altogether, but it is in such general use among growers that this is rendered impossible. The best thing, therefore, appears to be to accept the term "scab" as meaning a roughening or abnormal growth of the skin of the potato, with the proviso that the term conveys no suggestion as to how the abnormality is caused.

The skin of a potato is really of the nature of cork; it is only a thin layer, but so long as it is intact it is highly protective. When it suffers an injury, the potato endeavours to repair it by producing an extra amount of corky cell substance around the seat of injury, and thus isolate it from the healthy tissue. In this way a scab is produced, and scabbing may be regarded as the manifestation of the efforts of the plant to repair injury

and to protect itself from further attack. Various conditions have been at times suggested as the cause of scab, such as the presence of lime, ashes, fresh stable manure, cinders or grit in the soil; also the dryness of the season and the nature of the soil (acid, alkaline, sandy, heavy, &c.). Where experiments, carefully conducted with proper scientific precautions, have been carried out, it is becoming evident that some living organism is always the cause, and that the above conditions may influence its growth. In New South Wales the best known scab producers are eelworms, and also the fungus *Rhizoctonia*.

Sclerotium Disease of Beans and Peas.

A disease that is common to very many different plants, including beans and peas, is that known as sclerotium disease. It attacks the stems, commencing as a white mould at the ground line and working upwards. After the fungus has developed for some time the leaves become yellow and wilt, and finally the stem collapses owing to the fungus blocking up all the water-conducting channels. When the stem of the plant is hollow the fungus is produced in considerable quantity in the cavity, and forms numbers of lumps that are white at first, and then black, externally. These lumps vary in size up to that of a pea, and form a resting stage of the fungus. They remain either free in the soil or in decaying plants, and in the spring, develop small, brown, mushroom-like growths on long stems, which produce spores that are able to infect a new crop.

Diseased plants should be burned and not allowed to lie on the ground. The ground should be well limed, and the succeeding crop should be plants of a different family to that affected.

Soft Rot or Ring Rot of Sweet Potato.

This is not a serious field disease, though it occasionally occurs when wet conditions prevail at the time the plants are dug. However, it often causes much damage in forcing-beds and in storage. The symptoms of attack are a rapid softening of the whole potato, which on squeezing exudes a brown liquid. Sometimes only a dark ringed area is produced in the root. White tufts appear on the outside of the potato, and on these a number of black specks (the fruiting bodies of the fungus) are produced later. Rotted potatoes are soon invaded by other organisms, and become an evil-smelling disintegrating mass.

It is impossible to control this disease in the field before digging, but it is recommended that, before planting, the roots be treated with corrosive sublimate (made up of 1 oz. of the chemical in 8 gallons of water), by soaking them for ten minutes. Rather better results have been obtained with this solution than with the formalin method.

In harvesting for storage and for seed, the greatest care should be taken to avoid bruising.

Sunburn of Tomato.

Tomato fruit sometimes becomes scorched by the sun, spots being formed that at first are pale yellow, and later black. These spots sometimes resemble the diseased areas produced by ripe rot, and soon become infected by various fungi. Heavily foliaged varieties are less liable to attack, and if methods of cultivation, such as staking, are adopted, that will provide for the foliage shading the fruit, less damage will result. Plant as early as possible, so that plants will attain good growth before the approach of hot weather. Spraying will do no good.

White Rust of Turnip and Cabbage.

This fungus attacks nearly all plants belonging to the cabbage family in every part of the world. Among cruciferous weeds, Shepherd's Purse suffers most severely, and as this and other related weeds may harbour the pest, particular attention should be given to their destruction. The fungus attacks the plants when they are seedlings, and grows up with the plant. At a later stage it produces on the leaves, stem and flowers, small white areas presenting the appearance of little blisters. It should be remembered that infection can only be effected during the seedling stage, and therefore the seed-beds should occupy a fairly dry, open situation.

The fungus effects different hosts in varying ways. In the case of Shepherd's Purse, for example, the stems become enlarged and distorted, and usually no malformations of the flowers or leaves occur, while in the radish the flowers often become strikingly modified.

The methods of control recommended are: Rotation of crops (see page 22); destruction by burning of all diseased plants; destruction of cruciferous weeds which harbour this fungus, and the application of a mixture of equal parts of freshly-slaked lime and sulphur, which should be dusted on the plants.

Wilt of Tomato.

This is primarily a disease of the plant, and it is caused by a parasitic fungus that invades the vascular tissue and by its action produces wilting. A plant that is attacked gradually sickens, loses its green colour, wilts, and finally collapses to the ground. Plants are attacked here and there in the field, and if a badly-affected one or a dead one be pulled up, the roots are found to be decayed or destroyed by a dry rot. As the cause of the trouble is a soil dweller and a root parasite, spraying is of no value in controlling it, and good cultivation and rotation are the chief preventive measures.

Insect Pests.

W. W. Froggatt, F.L.S., Entomologist, and W. B. Gurney, Assistant Entomologist.

Vegetables are attacked by two kinds of insect pests—leaf-eating and sap-sucking—and growers must know to which of these two classes a particular insect belongs, in order to know what remedy to apply. Insects which eat the leaves have their mouth-parts formed for biting off pieces of vegetable matter, and in this way eat their food in much the same manner as do the higher animals. The insects which suck the plant juices have their mouth-parts formed into a beak, which is inserted into the plant tissues. The most notable amongst insects which chew their food is perhaps the larva of the cabbage moth. These insects can be destroyed by a stomach poison which when taken into the stomach along with the particles of food, kills them. We apply treatment for this class of insect to the plants, and make no effort to apply it directly to the insects. On the other hand the sucking insects such as aphis, bugs, &c., must be killed by actual contact—suffocation and irritation.

Aphis.

Small aphides (some winged and some not) make their appearance during the summer months on various plants. At this time they are all females, that have the power of giving birth to their young without the aid of males. The young aphides are born alive and in rapid succession, so that the numbers increase very rapidly. Towards the end of summer winged forms are developed more numerously, and the aphides spread. Winged males are also now developed and fertilise the females, which lay eggs (known as winter eggs) in the soil and decaying vegetation. It is these eggs that enable the aphis to tide the winter over. They hatch in the spring and start the broods of that season.

The effect of these thousands of tiny insects, each sucking up sap by means of its little beak is to weaken the plant, to reduce its vigour and profit, and even to cause it to wilt.

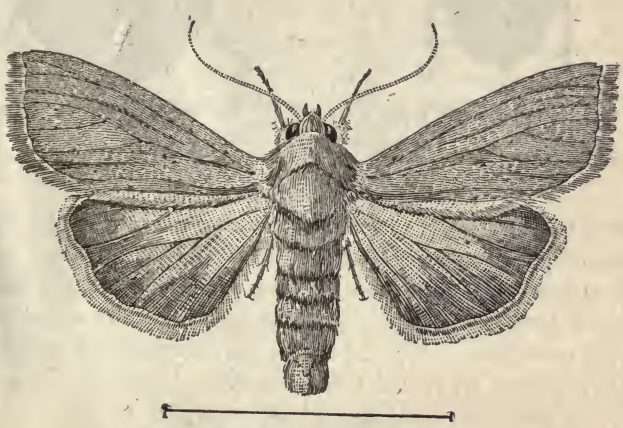
Spraying with tobacco or sunlight soap wash, or even a very dilute kerosene and soap wash, as directed on page 130, will keep these pests in check on such crops as peas, beans, cabbage, celery, &c.

When field crops of such vegetables as turnips are attacked, it is very difficult to spray, and the method of control must be clean cultivation, which kills the winter eggs. By attention to surface cultivation and manuring, healthy plants are raised which are more resistant to attack and less damage will result.

Fortunately there are an immense number of parasites which live upon and in all kinds of aphis, and they are a great factor in ordinary years in keeping the pest under control.

Army Worm Moth (*Cirphis unipuntcata*).

The army worm moth winters in the soil as a pupa, as a partly-grown grub, as an adult moth, and in the egg stage. The female moth may lay up to 700 eggs in a season (usually depositing them on grass leaves). From these eggs myriads of caterpillars appear. The eggs hatch in about ten days, and in three or four weeks the worms or grubs are full grown, when they bury themselves in the soil, change to the pupal stage, and after two weeks emerge again as adult moths. The grubs feed and move about much more freely in the daylight than other cutworms.



The Army Worm Moth (*Cirphis unipunctata*).
In the caterpillar stage, this moth is one of the worst pests of crops and grass.

When in the crops, the most effective method of destroying "army worms" and other night-feeding cutworms is the use of poisoned bran bait mentioned on page 131.

Where there is no danger to stock, poisoning the grass or a strip of the crop before the advancing caterpillars is effective; for this purpose use the following spray:—1 lb. of arsenite of soda, 4 lb. treacle, 16 gallons water; or 3 lb. of arsenate of lead to 50 gallons of water.

The Banded Pumpkin Beetle (*Aulocophora*).

This beetle is perhaps the worst of all leaf-eaters that attack garden crops. It usually makes its appearance just as the plants have made a good start, and if the season be favourable the infestation becomes so serious that the whole bed will soon be destroyed unless steps be taken to prevent it. Fortunately, the beetles are not often so numerous as this, but they must seriously reduce the returns in almost every season. In an ordinary season they appear about the middle of October, and are at their worst until the middle of November. They swarm on the upper surfaces of the leaves, eating

off the tissues till nothing but the dried skeleton remains; then they start on the next leaf. The flowers are also attacked from the edges and eaten off in the same manner.

A.—The Banded Pumpkin Beetle (*Aulocophora olivieri*).
B.—Indicating the natural size of the Beetle.

The 28-spotted Ladybird (*Epilachna 28-punctata*).

The adult beetle is of a general rich orange-yellow colour, marked with black, and measures about a quarter of an inch in length. It is rounded on the upper surface, and can be readily distinguished from the true ladybird beetles by its general elongated form, and by the thorax forming a neck between the head and body. In the ladybirds, the head and thorax fit as closely into the hind portion that the whole is almost circular.

Portion of a Pumpkin Leaf, showing ravages of 28-spotted Ladybird.

The larvæ are dull, whitish-coloured, elongated grubs, with the hind portion yellow, and measure about two-fifths of an inch. They are active little creatures, and feed on the stem and roots of the vines, sometimes gnawing their way into the base of the stem. When full grown, they pupate at a distance varying from 1 to 6 inches below the surface of the soil, and later emerge as the perfect beetle, to make a fresh attack on the surrounding vegetation.

If the plants are freely dusted on the upper surface with dry tobacco dust and slaked lime (see page 130), the beetles will be kept away. The work should be done in the morning, when the dew causes a better adhesion of the dust to the leaves. The beetles can also be collected on the foliage in the early morning, when they are more or less torpid and slow in rising if disturbed. Large numbers can be destroyed by drawing a shallow dish between the rows of the plants as described on page .

The discovery a few years ago that the larvæ infested the stems and roots, and the pupæ the soil beneath, indicated another important means of control. It is obvious that if all dead pumpkin and melon plants are cleaned up and burnt with any other rubbish on the ground, the hibernating beetles and their eggs will be destroyed, and if the soil is turned over early in the season and thoroughly disturbed, most of the delicate larvæ and pupæ in the soil will also be killed. Pumpkins, melons or related plants should not be grown on the same soil in successive years.

Buff-coloured Tomato Weevil (*Desiantha nociva*).

This small ground-coloured beetle, not half an inch long, with the head produced into a snout, feeds at night and hides by day in the soil and under dead leaves and stalks around the plants. It attacks the leaves and stems of tomatoes, cabbages, &c. The grubs of this beetle similarly attack the plants at night and hide in the soil by day.

It has been found simpler to trap the adult beetles (see page 132) than to spray with arsenate of lead (see page 129). Taking advantage of the habit of sheltering under dead leaves and rubbish, a few leaves or a handful of grass can be laid down alongside each plant, and other rubbish cleared away Collecting the beetles for several mornings in this way and by shaking them out of these traps into a bucket with a little oil and water in it will very quickly reduce the pest to a minimum.

Convolvulus Hawk-moth (*Protoparce convolvuli*).

A hawk-moth is sometimes a pest of the sweet potato. The caterpillars also attack convolvulus and privet foliage; they are of a general green colour, with paler coloured diagonal streaks along the sides of the body, and possess a spine or horn on top, near the hind end of the body. These caterpillars may vary much in colour; some are yellowish, and others, especially well-grown specimens, may be brown and almost black. They feed voraciously, riddling and even eating the leaves completely off, and grow to 3 inches in length, with thick bodies. When full grown, they bury themselves several inches down in the soil, where they pupate, changing into a dark chocolate-brown pupa, with a curved exposed beak shaped like a jug-handle. The first brood of pupæ produces a second brood of moths, which again lay eggs on the foliage and give rise to the second brood of caterpillars. The second brood, on pupating in the soil, may remain over winter as pupæ, and produce the first spring brood of moths next season.

The adult moth is dark-grey on the body and wings, with two rows of pink patches on the upper surface of the hind half of the body.

Once an attack has commenced, spraying with arsenate of lead (see page 129) can be recommended where the foliage is not very thick. This would be more effective against the young stages of the caterpillars. In dense plots of sweet potatoes there seems to be nothing to do except to now and again shake the plants and search for and destroy the caterpillars.

To prevent an infestation, turn up the soil in autumn and winter to expose and destroy hibernating pupæ in areas where they have previously attacked the crop.

In January, 1903, caterpillars attacked the sweet potato vines at Hawkesbury Agricultural College, and some of them grew to an immense size while feeding on the leaves. They completely denuded certain plants of leaves and stems, but a single application of Paris green destroyed them, after which the plants threw out fresh leaves, and seemed none the worse for the attack.

Cutworm (*Noctuidæ*).

The cutworm caterpillars, so prevalent in gardens, are generally found to be the grubs of the small brown Bugong moth. Swarms of this moth are in evidence about March, and each female lays several hundred eggs on weeds and grass. These may hatch in April, and the caterpillars do considerable damage to seedlings.

Trench for destroying Cutworms approaching crop.

It is of interest to note that though the frosts of winter destroy numbers of these caterpillars, and cold greatly retards their activity, yet they can be quite a serious pest in early winter. Numbers of the full-grown caterpillars pupate at this time, of course, and thus pass through the cold weather, emerging presently as the moths that lay the eggs from which the spring brood of caterpillars is hatched.

The habits of other cutworms differ slightly. They feed at night or dusk, or on cloudy days, attacking vegetables and garden plants. During the daytime they shelter in loose soil, dead leaves, or at

the base of plants. The caterpillars make their first appearance during August or September, and in warm districts there may be as many as four or more broods in a season.

They sometimes appear in spring in vast numbers with astonishing suddenness; in some part this is due to the fact that some cutworm caterpillars hibernate as partly-grown grubs through the winter, and suddenly crawl from the soil during the first warm days of spring. Others again appear as moths in the spring, and lay eggs, from which the new brood of caterpillars appears

It is difficult to combat the cutworms, but bran poisoned with Paris green, as described on page 131 has been found most effective.

The Diamond-backed Cabbage Moth (*Plutella maculipennis.*)

Under the name of "cabbage grub" or "cabbage worm," the caterpillar of the diamond-backed cabbage moth, once a European turnip pest, but now world-wide in its range, is well known to Australian cabbage-growers, as well as to the cabbage consumer when he finds the little green worms among the leaves of his purchase.

The life-history of this moth is so well known that it need only be briefly outlined. The moth, on the wing, appears to be of a uniform brown tint, and does not show the distinct, angular row of pale markings along the upper margin of the folded wings from which it takes its popular name, "diamond backed," and by which it can be so easily identified. It measures slightly over half an inch across the outspread wings. Emerging from the stout chrysalid skins which have protected them through the winter months, these active little moths lay their eggs upon the foliage of the young cabbage plants, and remain in hiding among the weeds and on the inner side of the cabbage leaves. As soon as fine weather sets in, if small brown moths are seen rising from the cabbages, it will be found that the leaves are marked with glassy spots, where the tiny, black-headed, pale-green caterpillars have been at work. So like the surface of the leaf are these caterpillars in coloration, that they would be easily passed over if it were not for their gnawing of the leaf.

Diamond-backed Cabbage Moth, viewed from above. [Enlarged.]

As they increase in size, they become slender, bright-green caterpillars (popularly known as "cabbage worms") and rest upon the surface of the leaves, gnawing holes right through them. At first they confine their attention to the larger outer leaves, but as they increase in numbers they gnaw all through the plant, and if they are allowed to reach this stage the cabbage or cauliflower is soon of no marketable value. The caterpillars are active little creatures, and if touched they roll away or drop from the leaf to the ground, often hanging suspended on a silken thread, and thus they escape their many enemies. When full grown, they betake themselves to the shelter of the under side of the leaf upon which they have been feeding, and spin a lattice-like, elongate, oval cocoon, or rather hammock, of silken strands, securely attached to the leaf, but open at both ends. It is such a flimsy, delicate structure that one can observe the transformation of the insect. At first a green pupa, it changes to dull brown, and finally reveals all the delicate outlines of the coming moth, enclosed in the pupal skin.

Our cabbage and cauliflower growers in many districts, grow these vegetables practically all through the year, the young plants often being set out alongside those ready for cutting, or upon the patches from which the marketable vegetables have been cut. Thus, with a continuous crop, the cabbage moth can breed all the year round. This is one of the reasons why the cabbage moth is such a serious pest in New South Wales.

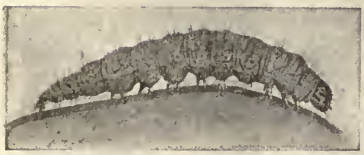
Many growers are not careful enough in seeing that the young cabbage plants which they buy are perfectly free of moth grubs. Anyone going around the Sydney shops when the suburban resident is busy planting his kitchen garden, and there is a brisk demand for cabbage plants, will see plants for sale with their leaves riddled with holes caused by the cabbage moth, and covered with grubs and eggs.

Unless the young plants in the seed-bed are treated until the time of planting out, they soon attract the moths from old cabbage patches. If all cabbage plants were carefully clipped and washed before they were planted out, they would have a fair start in life, without any aphis, cabbage moth, or other pests infesting them.

Then again, cabbage and cauliflowers are grown in other fields, and as soon as they are ready, all the marketable ones are cut and bagged. The unsaleable ones are left on the ground, to rot or run to seed, and remain until the owner wants the ground for something else, which may not be for months. This neglected plot is the breeding-ground for the cabbage moth and all other cabbage diseases, insect, and fungus.

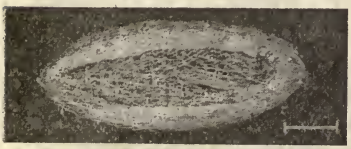
There is no doubt that the application of boiling water will kill all the grubs with which it comes in contact, without doing any serious damage to healthy plants. It is applied with a watering-can with a fine rose, the operator walking down between the rows and giving each infested cabbage

Leaf of Cabbage showing damage caused by Caterpillars of Cabbage Moth, with larvæ and cocoons on the leaf. [Reduced.]



Caterpillar. [Enlarged.]

Pupa (chrysalid) removed from cocoon. [Enlarged.]



Cocoon enclosing the pupa. [Enlarged.]

Cabbage Moth, side view. [Enlarged.]

The Diamond-backed Cabbage Moth (*Plutella maculipennis*).

or cauliflower a good sprinkle. This is very handy for a small garden patch, but in a large field it is difficult to keep a large quantity of water at the proper temperature, and to distribute it over a large area.

Some growers depend chiefly on kerosene emulsion, (see page 130), and keep the young plants clean until they begin to heart, when the danger is considered to be over. Lime and tobacco dust (see page 130) is a very effective remedy.

Start with clean cabbage plants in clean ground, and keep the ground clean; and after the crop is marketed clean up the cabbage patch. Then reinfestation will be less.

Before transplanting dip all young plants in any of the spray solutions mentioned on page 129 for sucking insects.

Poisons such as Paris green and arsenate of lead are not used by some growers, because they imagine that sufficient will remain to make the use of the plants unsafe. This is a fallacy. Spraying with solutions made of the following formulæ is recommended, and is quite safe :—

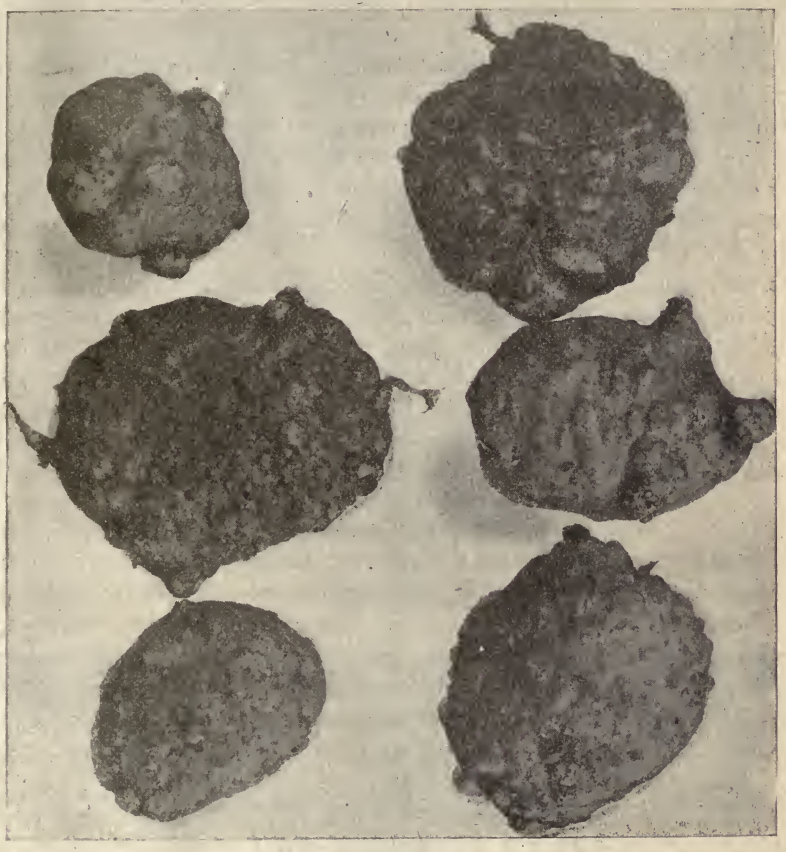
Paris green 1 lb., soap 3 lb., water 50 gallons.
Arsenate of lead 1 lb., soap 3 lb., water 25 gallons.

Eelworm causing Root Knot and Root Gall.

The disease known as root knot or root gall appears to be spreading very much in New South Wales. Such plants as pumpkins, melons, cabbage, cauliflower, spinach, lettuce, beans, peas, tomato, potato, carrot, and parsnip are attacked. The disease is readily seen on examining the roots. Irregular enlargements, either scattered or so close that the whole root system is abnormally thickened, will be seen. These enlargements interfere with the functions of the roots, and often the first indication of attack is the wilting and failure of the plant. In the potato plant the tubers themselves are usually attacked. Blister-like lumps are formed, and often the surfaces of these break, thus producing a very scabby appearance.

The cause of the injury is a tiny round worm, often called an eelworm, and also (from the effects of its attack) a gallworm, which belongs to a group of worms known as Nematodes. The life history of the worm is briefly as follows :—It hatches from an egg less than $\frac{1}{250}$ inch in length. The young larvæ move through the soil with considerable activity, and, on finding a root, bore their way into it. Once inside, the young worm ceases its active movements, and begins to enlarge. By means of a spearlike organ within its mouth, it commences to feed on the root tissues. Its presence irritates the tissues, and so stimulates them to enlarge, thus forming the gall. At the end of two to three weeks the different sexes become apparent, the female becoming pear-shaped, and large enough to be just visible to the unaided eye. It requires about four weeks in all for the female to develop from the egg and commence her own egg-laying. The eggs laid may be ten to fifteen a

day, and in warm weather they develop in about three days, but they take longer in cooler weather. The young worms are not very resistant to unfavourable weather conditions, and soil treatment aims at destroying the worms while still young and tender; the eggs have a resistant coating, and the mature females are safely protected inside the root. Drying out of the soil, or flooding the soil, is usually fatal to them in a comparatively short time. Soil kept free from vegetation for about two years usually results in the worms being killed out.



Potatoes infested with Eelworms.

Tubers and roots used as seed should be free from scab, as the scab areas may contain the worms.

In a small garden, two or three treatments of the soil, at intervals of about eight or ten days, with formalin 1 part, in water 50 parts, applied at the rate of 2 gallons to a square yard, should be used. It is of advantage to cover the soil with wet sacking after each application.

French Bean Fly (*Agromyza phaseoli*).

This little black fly, about one-twelfth of an inch in length, does a good deal of damage to French bean crops in some districts. The fly lays its eggs upon the stem near the ground, and the resultant maggots tunnel along under the skin, leaving the stem rusty-red and cracked, so that the plant eventually dies.

Growers report that spring crops are seldom, if ever, damaged to any appreciable extent, but as the weather becomes warmer the flies gradually breed up and develop in such numbers as to be very destructive in the fall of the year.

In good growing weather some advantage is gained by hilling up the soil round the plants, so that the stems are covered; the bean plant then puts out a fresh supply of fibrous roots above the damaged tissue. The hilling up also protects the stems from attack if it is done before the flies first appear. No spray or wash seems to have any effect upon the flies, and as the maggots do not feed upon the surface of the plant but under shelter of the tissue, no poisonous spray would affect them.

As with many other pests, this is a case for clean cultivation. The maggots pupate in the bean stems, from which, if the plants are allowed to remain in the field, the flies emerge in due course. It would be advisable to pull and burn all infested bean plants as soon as the last lot of beans has been gathered; otherwise, if the plants become dead and dry, pupæ may drop out of the cavities in the stems, and, falling on the earth, remain in the ground long after the dry stalks have been removed.

Onion Maggot (*Phorba ceparum*).

The worst insect pest of onions is the onion maggot. These maggots come from eggs deposited on the plant, and require about a week to hatch; the larvæ burrow into the bulbs and remain there about two weeks, then emerge and pupate in the ground. Their presence is first indicated by the tops turning yellow, then withering, and finally drying before the bulbs have matured.

It is difficult to suggest a remedy, but liming the soil is found to be beneficial, and if the infestation is very severe, rotation of crops (see page 22) should be tried.

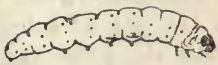
Potato Moth (*Phthorimæa operculella*).

This pest is more or less in evidence in every potato-growing district throughout the State, and the loss caused by it annually is enormous. The injury produced by the worm is extremely evident to the housekeeper (much of the infected tuber being cut to waste) and is well-known to all dealers in potatoes, but very generally they do not understand the nature of the insect producing the trouble. The injury done to the plant in the field is considerable, but not so great as that done to potatoes in store.

Potatoes left in the field after the previous season's harvesting provide the main harbour, and moths bred from these are on the wing and ready to infect the growing crop. The moths usually lay their eggs in the foliage,

A

B1



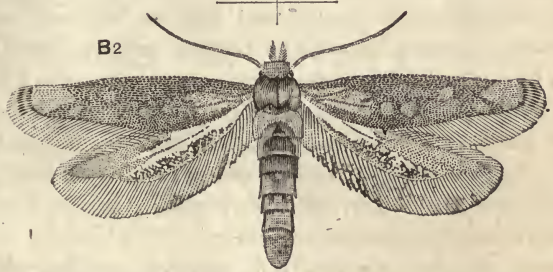
THE POTATO MOTH.

A—A potato showing traces of moth infestation on one side.

B1—The larva.

The lines indicate the natural size.

B2



B2—The adult Potato Moth.

C—The same potato cut open, showing how the larvæ affect the flesh.

C

generally at the base of a leaf; the larva when hatched, burrows its way down the stalk, and when full grown seeks a secluded spot, generally in the wilted tops, and pupates. If any tubers are not completely covered with soil, they will be infested. Potatoes are liable to infestation whether left in the field or placed in store after being dug.

The injury to the tuber is very similar to that done to the plant. The eye of the potatoes is usually the spot selected by the moth to lay its eggs. The larva, when hatched, channels its way through just beneath the skin, or through the substance of the tuber. Its presence can usually be detected by the castings or excrement which it throws out. Several larvæ have been found in the one tuber.

In suggesting remedies to control this pest, it is as well to point out that unless every grower does his part thoroughly and well no diminution need be expected; it will be of no avail for one grower to use every means to fight it if his careless and negligent neighbour does nothing but harbour the pest.

The battle should begin when cultivating. Where hilling is the practice it should be done with care, so that all tubers should be well covered with well-pulverised soil; no clods should be permitted, as they form crevices for the moth to make its way in and do its work of destruction. Where flat cultivation is practised, plant deeply and keep the soil well stirred. When the potatoes are dug they should be bagged without delay; if they are exposed even for a short while infestation is almost sure to follow. It will be particularly noticeable in a season when showers are frequent, that the percentage of infected tubers when dug, is considerably smaller than in a comparatively dry one. This is mainly owing to the rain breaking down the clods and compacting the soil, effectively closing any crevices, and thus preventing the moth from gaining an entrance to the tubers.

Many growers, after filling the bags, and before sewing them up, cover the mouth of the bag with stalks and leaves, probably to shade them from the sun. This practice cannot be too strongly condemned, as the moth is generally lurking in the haulms, and will immediately leave them to attack the potatoes. All stalks and foliage should be removed and burnt or destroyed as soon as possible. The bags should be sewn up immediately after filling and removed without delay to suitable storage. If it is not convenient to remove them for some time they should be placed in stacks and closely covered with some cloth or tarpaulin. Extreme care and watchfulness all along the line are necessary, particularly in storage. The majority of growers think that there the tubers are immune from attack. Far from it; more damage is done while in store than elsewhere. But if suitable storage is provided, the ravages of the moth can be better controlled than in the field.

Frequently potatoes are stacked in an open shed on the farm, and no precautions taken in the way of securely covering them. To prevent infestation they should be stacked in a tight room. On top of the stack place a shallow

vessel, and into this pour some bi-sulphide of carbon, and close the door tightly. This liquid becomes a gas when exposed to the air, and, being heavier than air, the fumes diffuse among the potatoes and destroy any moths and larvæ. This should be repeated every ten to fourteen days, in order to kill any larvæ or moths that might emerge from the egg stage. Four or five charges should be sufficient. About 5 lb. of liquid bi-sulphide of carbon to every 1,000 cubic feet of space should be used. As the gas is *highly inflammable*, the greatest care should be exercised. No lights of any kind should be near, or disastrous results will follow.

Of course it is recognised that many growers may not, perhaps, be in a position to provide themselves with a suitable airtight room, but every effort should be made to do so, and to adopt the treatment recommended. It will be found that the potatoes free from infestation will realise better prices, and the trouble and expense will be warranted. In the absence of such a store-room, the potatoes should be drawn into a heap, a saucer containing carbon bi-sulphide placed on top, and the whole covered closely with a cloth.

Covering with grass or hay from some place remote from the potato crop, and occasionally sprinkling with water, is a primitive method, but is found to keep the attack in check.

On small areas the moth may also be captured by use of lantern traps (see page 132).

Pseudo-looper or Silvery Plusia Moth (*Plusia Argentifera*).

The green caterpillar of this species of moth commonly feeds on the foliage of beans, creepers, and potatoes. They pupate in loose, silken cocoons, which they spin on the foliage or stalks and sometimes on the ground.

Brushing into a tray of oil and water, as is described on page 132, is recommended as a means of control, while spraying with arsenate of lead (see page 129), is also advantageous where the foliage is not too dense.

Rutherglen Bug (*Nysius vinitor*).

This little plant-bug is a tiny brown insect with silvery-grey wings, and measures about one-sixth of an inch in length. They suck up the sap with their beaks, and, where numerous, soon cause the plants to shrivel. They appear in summer from eggs that have been deposited on the grass and weeds by the autumn brood of the previous season, and are particularly fond of potato and tomato plants, although they infest many other plants and trees. They fly very well, and in the warmer part of the day are very active. For this reason, and because they shelter on the under-surfaces of the foliage, it is difficult to destroy them with a contact spray. The best method of destroying them is to use a shallow tray containing a mixture of water and kerosene, as described on page 130.

Slugs and Snails.

Probably the worst pests that the household gardener has to contend with are slugs and snails. Slugs are the worst of the two, and often cause such havoc among delicate vegetables as to prevent them coming to maturity; even when that stage is reached, they are not infrequently made unfit for market.

Dusting with tobacco dust mixed with five times the quantity of ashes, or sprinkling slaked lime around the plants, is recommended for the control of these pests.

Boards and flat stones scattered about, with a sprinkling of poisoned bran (see page 131) around and under them, act as traps, and enable one to collect quickly and destroy numbers at a time; if persisted in for some days, this considerably reduces the number of pests in a plot.

Obviously, too, heaps of stones, boards or rubbish, if only providing shelter for the pest. should be removed from the vicinity of the crop.

Slugs also dislike soot, sifted wood ashes, and sawdust wetted with weak carbolic acid and sprinkled along both sides of the row.

(See also page 131).

Spotted Ladybird (*Epilachna*).

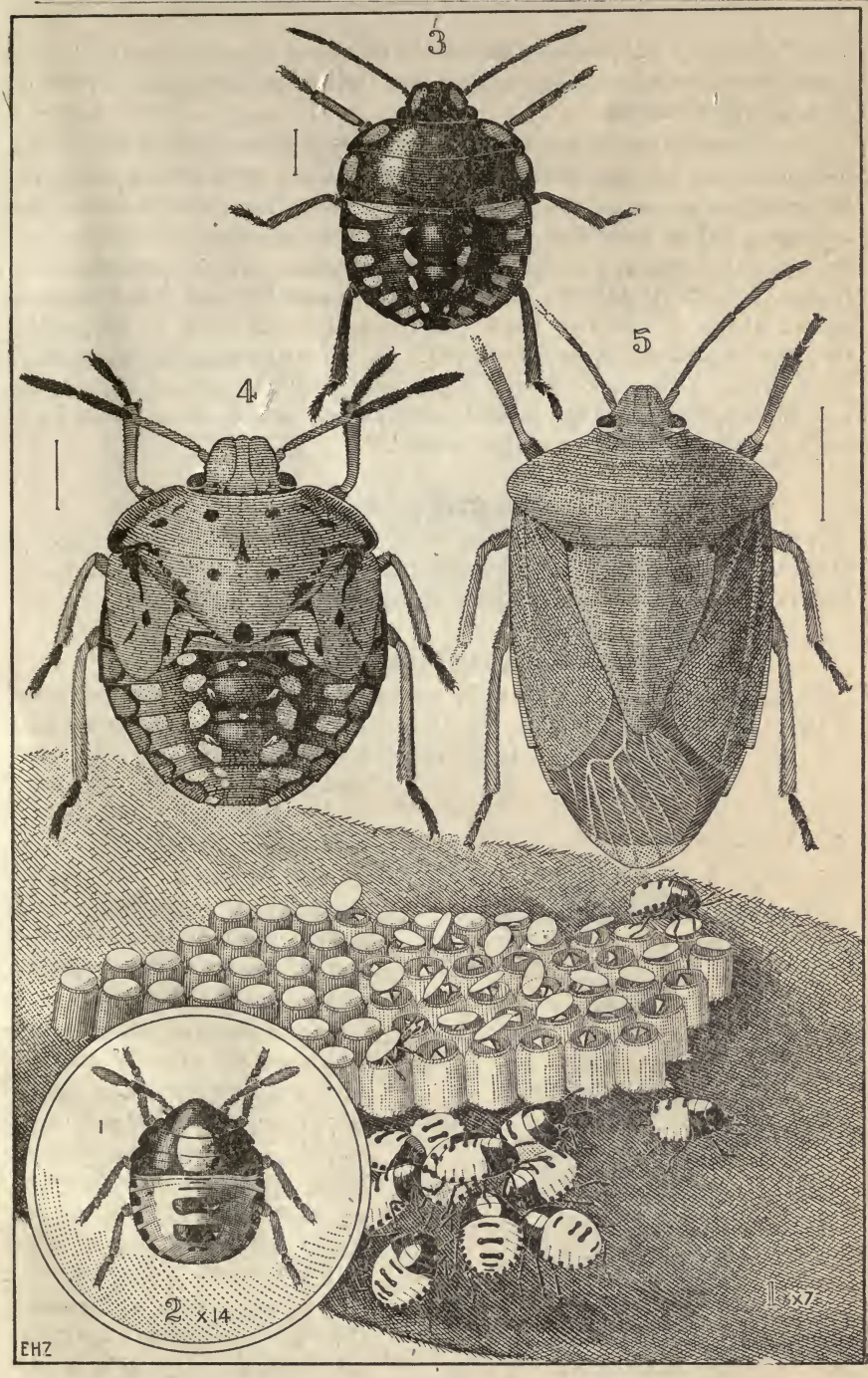
Much the same damage is done by the 28-Spotted Ladybird (for illustration see page 112) as by the Banded Pumpkin Beetle. Dusting the plants with lime and tobacco dust (see page 130), and spraying with arsenate of lead (see page 129) are recommended as means of control.

Tomato and Bean Bug, or Green Bug (*Cuspicona*).

This cosmopolitan plant bug is quite a modern introduction into our vegetable gardens. It first appeared upon tomato plants in the neighbourhood of Sydney about ten years ago; since then it has increased in numbers and for the last few years has been noted as a pest upon the fruits and foliage of the tomato, the foilage and young pods of French beans, and upon potato plants. How far they have extended their range outside the county of Cumberland it is hard to say, but as the species is known in Florida, U.S.A., as an orange pest, it may easily become established in the citrus orchards of New South Wales.

This bug attacks plants by inserting its beak into the tissue and sucking up the sap. The adult is of a uniform rich green tint and of a typical shield shape. The legs are well developed, and the insect can run and fly very well when disturbed from its food plant, but generally it drops to the ground when the plants are touched. The female lays her eggs in little patches, side by side, on the surface of the foliage of the young plants; the baby bugs, when ready to emerge, push off the flattened lid, leaving the empty eggs like glass cups.

The young bugs on emergence are dark coloured, but during their successive moults they gradually change to a lighter colour, until at the final moult they appear perfect, green shield bugs, with well-developed flying wings.



THE TOMATO AND BEAN BUG (*Cuspicona*).

DESCRIPTION OF PLATE.—1. Cluster of eggs and young bugs immediately after leaving the egg shells. 2. Enlarged figure of young bug just emerged from egg. 3. Second stage after leaving egg. 4. Last stage of immature bug, showing definite wing pads. 5. Adult bug with fully developed wings; leaf green in colour.

These adult bugs when resting among the foliage of a tomato plant can easily escape detection even by the practised eye, their colour harmonises so closely with that of the leaves.

The clusters of rounded, flat-topped, glassy eggs are very noticeable on the foliage, and if the egg-infested leaves were snipped off and dropped into a tin when the gardener was going over his plants, large numbers would be destroyed before they had hatched. Later, or whenever an odd bug is noticed on the plants, if a bag or sheet can be placed on the ground under the foliage, or an old umbrella can be placed against the side of the plants, a sudden shake of the free hand will cause most of them to fall, when they can be gathered up and destroyed. In the early stages of the development of the little dark-coloured bugs, when their integument is not dense and the wing-covers are not present, an oil spray or tobacco and soap wash (see page 130) will act as a contact poison.

Turnip Caterpillar (*Godara comalis*).

A small light-brown moth in its caterpillar stage attacks the foliage of turnips and horse-radish. Where plentiful enough to seriously affect the turnips, a spray of arsenate of lead (see page 129) should be used.

Weevil of Pea and Bean Seeds (*Bruchus*).

The grubs and adult beetles of a weevil commonly attack pea and bean seeds. Though these beetles lay their eggs in the field, their ravages are not generally sufficient to be noted until after the crop has been gathered and stored. Then the grubs become full grown, pupate, and change to the adult form within the seed. This brood will again lay eggs on the seeds around them in the store, and the infestation is thus increased and with it the damage.

Bean Weevil
(*Bruchus obtectus*).

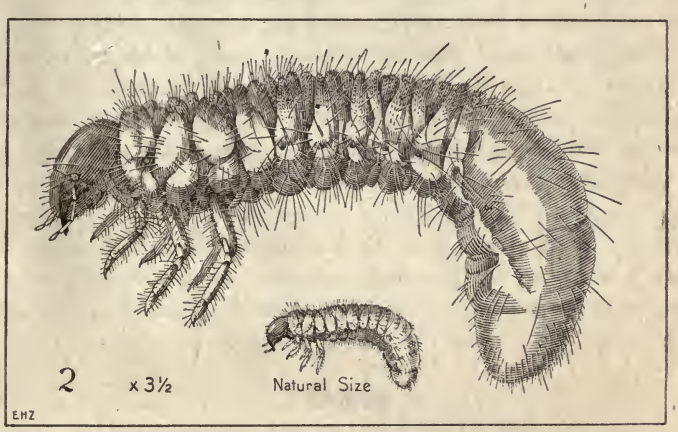
For destroying these pests, which are the cause of the loss of a large percentage of stored seed, fumigation with carbon bisulphide is best, the method being similar to that described on page 131. The fumes are highly inflammable, and no lights or pipes should be allowed near.

Keeping seed in cold storage (35 deg. Fah.) destroys the grubs and beetles, and, even if it does not destroy the eggs, it prevents their development.

White Grub.

These are the thick, white, curved grubs so common in the soil, and often turned up when digging. They are the larval or grub state of the common "King" or "Christmas" beetles and their allies, the "chafers." They vary much in size, according to the age or the species, but are all very similar in appearance. These grubs remain feeding in the soil on grass and crop roots for two years or more before becoming full-grown, when they construct a soft, rounded earthern cocoon, pupate therein, and thus pass their last winter in the soil, to appear the following summer as adult beetles, which feed on foliage.

Where these grubs appear, rotation is recommended. The change crop in each case is not so seriously infested, and return can afterwards be made to



White Grub.

the original crop. Deep working of the soil in late autumn is recommended, as it destroys numbers of those which have pupated, by breaking their earthen cells and exposing the helpless pupæ to other insects, birds, and frost. Treatment of the soil with lime, apterite, &c., has not been found to give satisfactory results.

Wireworm.

Wireworms are the hard-bodied, smooth, yellowish-white grubs, commonly found in the soil, and varying in sizes up to 1½ inches in length. These active, wiry, quick-moving grubs or wireworms are the larvæ of the common brownish beetles known as "click" or "skip-jack" beetles, and the grubs remain at work feeding on roots and growing in the soil from three to five years, when, like the white grubs, they construct a small cell to pupate in, and appear as the common brown beetle.

Cultivation in the autumn destroys numbers of the cells and pupæ, and rotation of crops is also recommended.

Wireworms can be destroyed by feeding on bran poisoned with Paris green (see page 131).

Controls for Diseases and Pests.

Diseases and pests may not be prevalent every year, but experience has shown that they recur frequently, and in years of serious epidemics the profits are to the man who takes early protective measures. Success in vegetable culture depends largely on cultivation, manuring, and the control of pests and diseases, and the last operation is not the least important.

GENERAL DIRECTIONS.

In the treatment of pests and diseases, the principal point is what remedy to use. The grower must first identify the cause of his trouble, and then treat it according to its nature. Treatment must be thorough, or the time and labour are wasted. A knowledge of the enemies to be treated, and of the remedies found to be most effective, their preparation, and the proper time for the application is essential. Prevention of fungus diseases is possible; but their cure is hardly practicable. When failure occurs, it may generally be attributed to the lateness of the treatment. Success in controlling pests will only be obtained by thorough attention to details. Be very careful, in buying mixtures, to obtain them from reliable firms only, and after they have been thoroughly tested.

SPRAYS.

The principal fungicide used is Bordeaux mixture, and the insecticides, which have proved the most efficacious, are arsenate of lead, for leaf-eating insects, and kerosene emulsion, resin wash, miscible oils, and tobacco solutions for sap-sucking insects.

For applying sprays, the vegetable grower will require a knapsack spray or a hand syringe according to the area to be treated. If possible spraying should not be carried out in direct sunlight during the heat of the day. During periods of rapid growth and after summer rains, spraying should be carried out frequently, though not before the foliage is dry.

Bordeaux Mixture for Fungus Diseases.

The following formula is recommended for use in spraying vegetables :— Copper sulphate (bluestone) 1 lb., freshly-burnt lime 1 lb., water 20 gallons.

For the copper sulphate solution, wooden vessels are preferable, though copper ones may be used. Iron should be avoided. It is immaterial whether hot or cold water be used to dissolve the bluestone. If the mixture is to be made in a hurry, it is best to dissolve the copper sulphate in hot water. If there is plenty of time use cold water; but in this case the bluestone must

be suspended in a porous bag (bit of muslin or sacking) as near the surface of the water as possible. If the bluestone is thrown into the vessel, and water poured on the top of it, it will not dissolve in a week. When suspended as described, it should dissolve in about twenty-four hours.

The bluestone solution when made must be diluted until there are 10 gallons of solution, before the lime solution is added to it. This is a very important point. If the copper solution is too strong, the precipitate formed is thick and heavy, and liable to clog the nozzle of the spray-pump.

The lime, which should be freshly burnt, should be slacked with a small quantity of water. Slacking on a board is to be recommended rather than in a cask, because if the lime is really freshly burnt there will be considerable heat evolved, and the barrel may suffer. Place the whole of the lime on a board, and pour over it about a pint of water. The lime, if it is good, should become very hot, crack asunder, give off a quantity of steam, and finally crumble into a fine white powder This is now emptied into a barrel and the other 10 gallons of water added. Stir and allow to settle, then pour off the milky solution through a strainer.

Finally run both the lime and bluestone solutions, at the same time, into a third vessel.

For diseases such as late (or Irish) blight of potatoes and tomatoes, use only half the quantity of water given above.

Arsenate of Lead for Leaf-eating Insects.

For the destruction of leaf-eating insects, arsenate of lead has proved most efficient. The spray is simply made by taking $1\frac{3}{4}$ oz. of dry arsenate of lead powder and mixing it with 5 gallons of water. A thin paste is made with the powder first, and this is stirred into the vat containing the quantity of water required. It is important to make sure that the powder is thoroughly wet throughout before the paste is diluted, otherwise some will simply sink to the bottom and be lost. If arsenate of lead is purchased, twice the above amount as specified for powder is required. It is important to keep the mixture well agitated when spraying.

Sprays for Sucking Insects.

Miscible Oils.—There are several brands of miscible oils on the market. They are for the most part petroleum products that have been so treated as to make them mix quite freely with water. These oils are efficient and useful (especially for controlling aphis) but must be used with caution, as serious injury to the plants is caused if they are too strong. The manufacturers directions should be carefully followed.

Tobacco Washes.—Highly concentrated nicotine extracts are obtainable and are more convenient to the vegetable grower than home-made preparations. The manufacturers supply directions for mixing which should be carefully followed.

As a contact spray these mixtures are particularly useful in the treatment of aphis.

Sunlight Soap Wash.—Another useful spray for aphides, &c., can be made by dissolving a cake of Sunlight soap in 2 gallons of water, and spraying when warm. This is easy to mix, and has given satisfactory results.

Kerosene Emulsion.—The prepared spraying oils of heavier nature, under various brands, have mostly taken the place of kerosene emulsion, but it is still used by a good many gardeners.

A stock solution can be prepared as follows:—

Hard soap, ½ lb.

Kerosene, 2 gallons.

Boiling water, 1 gallon.

Dissolve ½ lb. of hard soap in 1 gallon of boiling water; while still boiling stir in 2 gallons of kerosene, then immediately pump the whole from one vessel into another. The outlet from the short delivery hose (or iron pipe—for the rubber perishes) should be small enough to enable a good pressure to be maintained whilst pumping; a course spray nozzle on the end of the outlet hose or pipe will suffice.

If any trouble is found in emulsifying these proportions, a greater quantity of the boiling soap solution should be added, and the whole put through the pump again.

Treat the above as a stock solution, and dilute it with boiling water to make the total solution 22 gallons before using. For tender plants more water should be used. Soft water only should be used for mixing and diluting.

Kerosene is very severe on rubber hoses, and they should have a warm soda solution pumped through them after use to clear them thoroughly of the oil.

OTHER METHODS OF CONTROL.

In addition to spraying to control diseases and pests, other means are sometimes adopted. The chief of these are as follows:—

Lime and Tobacco Dust.—This mixture is particularly useful for insects like cabbage moth grubs, pumpkin beetles, slugs, and snails. It consists of freshly slaked lime-dust, and tobacco-dust, mixed dry, in the proportion of 4 to 1. After mixing these well together, dust the mixture by hand over the plants. Apply during the early morning when the dew is on the leaves.

About 1,000 cabbage plants can be dusted in an hour, and one kerosene tinful of the mixture will do 400 plants.

For slugs and snails some growers prefer to use slaked lime by itself and to sprinkle it around the plants. Others mix tobacco dust with five times its quantity of ashes and dust the plants with the mixture. (See also page 124).

Sulphur Powder.—Flowers of sulphur are used to control mildews. It should be applied by means of bellows in the early spring, and at any time later in the season when the disease is observed. The early morning is generally the best time for the application.

Poisoned bait, consisting of 1 lb. Paris green or commercial arsenic to 24 lb. bran, 3 oz. salt, and 3 quarts of water can be recommended for most cutworms. This bait when mixed makes a crumbly mash which is scattered lightly throughout the crop or along the rows of seedlings at the rate of 50 to 75 lb. per acre. Another bait is green corn, lucerne or potato tops cut in the chaff-cutter, and dipped in Paris green water. Such treated areas, of course, should not be open to stock. A straight-walled deep furrow ploughed in front of advancing cutworms arrests thousands, which fall into the trench where they accumulate and can be sprayed with oil sprays or crushed with a heavy log drawn along the furrow.

Fumigation is used as a means of destroying the moths, grubs, and larvæ of the potato moth in stored potatoes, and for cleansing the seed of such crops as peas, beans, &c., which are attacked by weevil.

The seed to be treated should be placed in a barrel or bin, or better still in an iron water tank, and the lid adjusted so that it can be weighted down and made airtight. A ring of rubber gas tubing can be often successfully used for the purpose, or if this is not possible, cloth of close texture should be substituted.

Better results are obtained if the operation is carried out in the spring or summer, than in the winter; the temperature should be about 70 deg. Fah.

The liquid carbon bisulphide, which is used for this purpose, is placed in a saucer or dish on top of the seed in the barrel, and the top securely fastened down. This liquid readily becomes a gas which is heavier than air, and the fumes sink down through the seed; hence the reason for placing it on top of the seed.

For a well-sealed tank or cask, at a temperature of 70 deg. Fah., use 1 fluid oz. of carbon bisulphide to every 16 cubic feet of space, and if the temperature is below 65 deg. Fah.—or, where the vessel is not perfectly airtight—use 1½ fluid oz.

One teaspoonful is more than sufficient for a kerosene tin of seed.

The seed should be left in the gas for from 20 to 24 hours, never more than 30 hours, and at the end of that time the fumes should be dislodged by stirring the grain.

Soil Sterilisatio —Seedlings may be infected by disease spores in the soil; indeed, wilt disease can usually be attributed to that method of infection.

In the island of Jersey, where tomatoes are extensively grown, wilt at one time threatened to seriously affect the industry. On the suggestion of a scientist, sterilisation of the soil by means of baking was adopted and the trouble ceased. On the larger holdings, kilns have now been erected, and the soil is sterilised in quantities of one or two dray loads. In addition to sterilising soil, the larger growers supply seedlings raised in sterile soil.

Wilt has caused considerable trouble in this State, and this method should be worthy of adoption by small growers. The writer has had excellent results by baking half a kerosene tin of earth with a cover placed on top to keep in the steam for an hour in an ordinary kitchen oven.

Not only is this treatment effective in destroying disease spores, but it also kills all weed seeds, and the labour of weeding the seed-box is thus saved.

Formalin Soil Treatment.—As a preventive measure against fungus diseases, it has often been found advantageous to treat the soil in the seed-bed with a formalin solution, made up at the rate of 1 part formalin to 100 parts water. This should be applied at the rate of 1 gallon to the square yard, and the soil covered with wet bags to keep in the gas. The treatment is also effective in the case of eelworms.

Mosquito netting is very effective in protecting seed beds from the infestation of insects, and during attacks of the pumpkin-beetle has proved most effective in warding off attacks.

Trapping Moths.—A simple and effective plan of preventing the attack of many grubs is to trap the moths before they have an opportunity of depositing their eggs. The best means of doing this is to use a tarred barrel (such as a cement cask) in which a lamp is left burning during the night. The light attracts the moths, and if the inside of the barrel is kept freshly tarred many will be destroyed.

Shaking Off.—Several insects are best destroyed by drawing a shallow trough containing a mixture of kerosene and water between the rows, while someone following behind beats or brushes the bushes, so that numbers of the insects are dislodged and precipitated into the trough.

Rotation of crops (see page 22) and clean methods of cultivation may be regarded as methods of control for practically all diseases and pests. The destruction of diseased plant remains by burning must be regarded as an important feature of clean cultivation.

Planting Calendars.

COASTAL DISTRICTS.

Crop.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Artichoke (Jerusalem)	...	...	...	...	...	...	X	X	X	...	..	...
Asparagus	...	...	...	...	...	T	T	XT	X	X	...	...
Beans (Broad)	...	X	X	X	X	X	...	...	...	...	...	...
Beans (other varieties)	X	X	X	X*	..	...	X*	X	X	X	X	X
Beet	X	X	X	X	X	X	X	X	X	X	...	...
Cabbage	X	XT	XT	XT	XT	XT	T	T	...	...	...	X
Carrot	...	X	X	X	X	X	X	X	X	X	...	...
Cauliflower	X	XT	XT	T	...	...	...	...	...	...	...	X
Celery	T	XT	XT	T	T	...	...	...	...	...	...	X
Choko	.	...	...	...	...	...	T	T	T	...	...	...
Cucumber	X	X	...	...	...	...	X*	X	X	X	X	X
Eschalot	...	T	T	T	T	T	T	T	T	T	...	...
Herbs	...	...	X	X	XT	T	T	XT	XT	XT	...	...
Leek	X	X	X	XT	XT	T	T	X	X	...	...	..
Lettuce	X	X	XT	XT	XT	XT	XT	XT	XT	XT	X	X
Melon	...	...	...	...	...	...	...	...	X	X	X	X
Onion	...	X	X	XT	XT	T	T	XT	...	...	...	...
Parsnip	X	X	X	X	X	...	...	X	X	X	...	...
Peas	...	X	X	X	X	X	X	X	X	X	...	...
Potato	...	X	X	...	...	...	X*	X	...	...	...	...
Pumpkin	..	...	...	...	...	..	...	...	X	X	X	X
Radish	X	X	X	X	X	X	X	X	X	X	X	X
Rhubarb	...	..	..	...	T	T	T	XT	X	X	...	...
Silver Beet	X	XT	XT	XT	XT	XT	XT	XT	XT	XT	T	...
Spinach	...	...	X	X	X	X	X	X	...	...	...	...
Squash	X	...	...	...	...	...	...	X	X	X	X	X
Sweet potato	...	...	...	..	...	...	..	T*	T	T	T	T
Tomato	XT	T	T	T*	...	X*	X*	XT*	XT	XT	XT	XT
Turnip	...	X	X	X	X	X	X	X	X	...	...	...
Turnip (Swede)	...	X	X	X	X	...	...	...	...	...	...	...

X signifies suitable sowing period.

T „ „ transplanting period.

* „ plant in frost-free situations only.

TABLELAND DISTRICTS.

Crop.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Artichoke, Jerusalem	...	...	...	...	...	...	...	...	X	X	...	...
Asparagus	...	...	...	...	...	...	T	T	...	X	X	...
Beans, Broad	X	X	X	X	X	X	X	X	X	...	...	...
,, other varieties	X	...	...	...	...	...	...	...	X	X	X	X
Beet	...	X	X	X	X	...	...	X	X	X	X	X
Cabbage	XT	XT	XT	XT	XT	XT	XT	XT	XT	XT	XT	XT
Carrot	...	X	X	...	...	...	...	X	X	X	X	...
Cauliflower	XT	T	T	...	..	...	...	...	...	...	...	X
Celery	T	XT	...	...	...	...	...	...	...	...	...	X
Choko	...	...	...	...	..	...	...	...	T*	T	T	...
Cucumber	X	...	...	...	...	...	...	...	X*	X	X	X
Eschalot	...	T	T	T	T	T	T	T	...	...	...	...
Herbs	...	...	...	X	X	T	T	XT	XT	XT	...	...
Leek	XT	XT	XT	XT	T	T	T	.	...	...	...	X
Lettuce	X	X	X	X	X	X	X	XT	XT	XT	XT	X
Melon	...	...	...	...	...	...	...	...	X	X	X	...
Onion	...	X	XT	XT	XT	T	T	XT	...	...	...	...
Parsnip	X	X	X	...	...	...	...	X	X	X	X	X
Peas	...	...	...	...	...	...	X	X	X	X	X	X
Potato	.	...	...	...	...	...	...	...	X	X	X	X
Pumpkin	...	...	...	...	...	...	...	...	X	X	X	...
Radish	X	X	X	X	X	X	X	X	X	X	X	X
Rhubarb	...	...	...	...	T	T	T	T	...	X	X	...
Silver Beet	X	XT	XT	XT	T	...	...	X	XT	XT	T	...
Spinach	...	X	X	X	X	...	...	...	..	...	...	...
Squash	X	...	...	...	...	...	...	...	X*	X	X	X
Sweet Potato	...	...	...	...	...	...	...	...	...	T	T	...
Tomato	...	...	...	...	...	...	...	X*	XT	XT	XT	T
Turnip	...	X	X	X	X	...	...	X	X	X	...	...
,, Swede	X	X	X	...	...	...	...	...	...	...	...	...

X signifies suitable sowing period.

T ,, ,, transplanting period.

* ,, plant in frost-free situations only.

INDEX.

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BENTON'S BEAUTEOUS BERRIES.

The Productive "Caringberry."

As grown by Govt. Experimental Farms, Hawkesbury, Yanco, Etc.

The **Caringberry** was brought to Australia some five years ago. The original was a native of Montana, U.S.A., and is a cross between the Mulberry and Raspberry on the parent plant of the American Blackberry. Has the combined flavours of the Raspberry and Mulberry.

The **Caringberry** is used extensively in all large cities of America in fruit salads. Many growers of the Strawberries in America are discarding them, as it is so much easier to grow **Caringberries.** Not affected by pests or birds like Strawberries or other fruits.

3 Plants 7/6. 12 Plants £1/1/-. 100 Plants £7.

Fruit Farmers cannot afford to be without them.

The Prolific "Bluberry."

Five years ago the **Bluberry**—which is a cross between the **Lawtonberry, Mulberry,** and Red Logan—was first propagated by us. It combines the flavours of the **Lawtonberry,** Red Logan, and, like the Caringberry, not having so much waste as the Strawberry, it commands a higher price for the fruit. In fact, one-time Strawberry growers are giving the **Bluberry** preference, as it is not affected by pests or birds, and is consequently so much easier to grow. Being disease proof, it does not require replanting for at least 20 years. It fruits between November and March, just when fruit salads are required. The fruit carries and sells well; as it does not require much room, and is easy to pick, there is a great future for the **Bluberry** in Australia.

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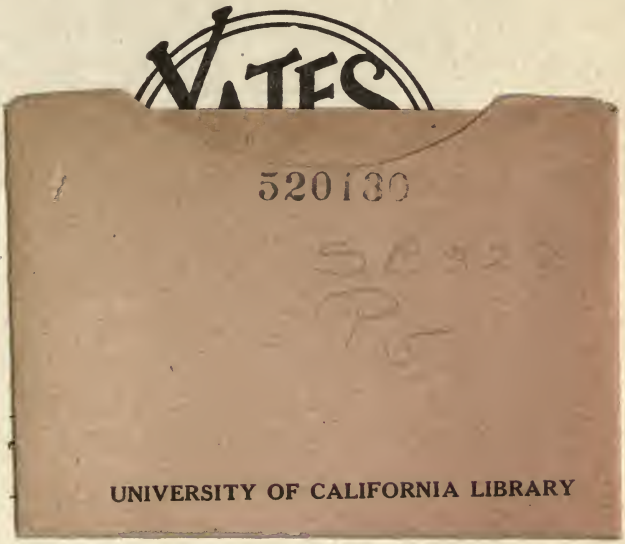

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